



FEDERATION OF MALAYA

ANNUAL REPORT

of the

DEPARTMENT OF AGRICULTURE

for the year

1957

By

R. G. HEATH

*Director of Agriculture
Federation of Malaya*

Price: \$2.50





A Malay farmer, just visible, standing among his heavy padi crop. The variety is Radin Puteh. (Tanjong Karang, Selangor, 1956/57 season.)



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ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA, FOR THE YEAR 1957

SECTION I

POLICY AND PROGRESS

A.—POLICY

The agricultural policy of the Government was laid down in broad terms in the Alliance Platform for the Federal Elections and is as follows:

1. Eventually to achieve self-sufficiency in essential food-stuffs;
2. (a) Increasing quantitatively and qualitatively existing agricultural produce and diversifying crops;
(b) Improving marketing systems;
(c) Giving financial assistance to agriculturists through the Land Bank and other agencies;
(d) Ensuring security to cultivators; and
(e) Providing agricultural education on as extensive a scale as possible.

The Department is concerned in a major degree with 1 and 2a and e above and in some degree with the remaining items.

B.—ORGANISATION OF THE DEPARTMENT

2. The organisation of the Department has remained as described in the 1956 Report, with the Federal section responsible for research and investigation work and for higher agricultural education and the State sections for extension activities. Clause 94 (1) of the new Constitution does, however, provide for a closer measure of Federal control of the activities of the extension services.

C.—FINANCE

3. Considerable additional funds were provided during the year for research and investigation work and also for improved facilities in respect of higher agricultural education; these funds formed part of the budget for the second Draft Development Plan.

4. The 1958 Estimates for the Federal section of the Department have the effect of restoring the 1953 position in respect of annually recurrent expenditure. A cut of more than \$500,000 was imposed by the Treasury on the annually recurrent expenditure of the Department in 1954 and seriously dislocated research and investigation work at the time.

5. It is unfortunate that the steadily deteriorating staffing position will prevent the Department from utilising to major advantage the improving position of its finances.

D.—STAFF

6. The number of expatriate officers retiring or proceeding on leave prior to retirement normally, was one. Those retiring under Malayanisation scheme during the year numbered sixteen; in addition, one officer died while on vacation leave in the United Kingdom. Eight of the officers concerned were of superscale rank and were thus very experienced men. The number of Malayan officers returning from overseas training to occupy Division I posts was two only. There were twenty-eight vacancies in the Division I establishment, exclusive of leave reserves, at the close of the year, the percentage strength of posts filled on the same basis being 63 per cent.

7. The Department will however suffer its most severe loss early in 1958 with the retirement of the Director, Deputy Director and two Assistant Directors under the Malayanisation scheme; when they have left there will be only one pre-war Division I officer remaining in the Department.

8. Manifestly no Department can face losses of experienced staff such as those described above, without corresponding replacement, and at the same time maintain its previous standards of efficiency. All that can fairly be expected during the next 2-3 years, is for the Department and its major activities of work to be maintained on a reasonably even keel over the period. If additional commitments are expected of it, additional staff of the right calibre must somehow be provided.

9. There is very promising material among the thirteen Malayan officers now in Division I posts with the Department, following advanced training overseas. It is a matter of regret however that almost all the most experienced members of the expatriate staff have either left or are about to leave the Department as the services of these officers would have been most valuable in the training of the Malayan officers. It is expected that a further six Malayan officers will return from overseas training in 1958, with two more early in 1959. Expatriate departures in 1958, so far known, will amount to six.

10. There are thirty-three vacancies in the Agricultural Assistant cadre and it is estimated that it will take another 3-4 years to overcome this deficiency, having regard to the need to provide for retirements, casualties and those transferring to other duties.

11. It is the policy of the Department considerably to increase the number of Junior Agricultural Assistants, both at Federal and State level, to provide more effective contact with the cultivator on the ground. There is no difficulty in recruiting men of good type, with a suitable background, for this class of officer.

E.—PROGRESS IN 1957

12. Despite the steady deterioration in the staffing position, the major activities of the Department have been effectively maintained, and to some extent increased, during the year. The policy of maintaining a strong team at Headquarters to provide direction and guidance of a positive nature has played a large part in sustaining the Departmental effort as a whole.

13. The main lines of Departmental activity and the progress made during the year were briefly as follows:

14. *Rubber*.—The Department continued to be responsible for the supply of approved planting material to smallholders carrying out both replanting and new planting; also to assist with the administration, at State level, of the Smallholders Advisory Service of the Rubber Research Institute and in addition to advise the Rubber Industry (Replanting) Board on all matters affecting the replacement, by smallholders engaged in replanting, of their rubber by other approved crops.

15. There were unforeseen delays in finalising the Government Scheme to provide financial assistance to smallholders carrying out new planting in blocks, which is now expected to come into operation early in 1958.

16. *Padi*.—The methods which the Department is utilising in endeavouring to increase padi yields are broadly as follows:

- (a) The selection and breeding of improved varieties.
- (b) The use of fertilisers, both in the nursery and in the field.
- (c) The use of improved cultivation techniques i.e., seedlings of optimum age, correct spacing, correct time of planting, regular weeding, etc.
- (d) Efficient control of diseases and pests.
- (e) Mechanisation in suitable areas.

17. The selection and breeding work has reached the stage of mass distribution in two States with more to follow in the next year or two. Fertiliser subsidy schemes are in operation in four States and a scheme has recently been drafted which would provide for a fertiliser subsidy on a country-wide basis. As an example of what can be achieved by greater attention to cultivation techniques, yields in the Jelebu district of Negri Sembilan have been maintained at a level 60 per cent above those harvested prior to 1954, as a direct result of changing to Departmentally recommended planting dates. Departmental pest control units are now operating in all the major padi areas while progress is being made in investigations aimed at controlling stem borers and *penyakit merah*, two important causative factors in reducing yields. In the field of mechanisation a considerable amount of assistance has been given in the cultivation of land by machinery; this has been facilitated by the increasing numbers of private operators now contracting for such work.

18. The padi crop for the 1956/57 season was a record one, the equivalent of 461,940 tons of rice being produced, and the upward trend of yields in recent years is expected to continue as the various measures for improvement recommended by the Department are applied in still greater degree and as the numerous schemes of improvement undertaken by the Drainage and Irrigation Department continue likewise to exert their effect.

19. *Coconut*.—Development of the two new stations for research and investigation work on the crop has progressed well; these are the selection and breeding station in the Bagan Datoh area of Perak and the station in West Johore for the study of rehabilitation problems.

20. The working Party set up to study the problems of the coconut industry reported towards the end of the year, in favour of a replanting scheme, initially on a pilot basis. The first draft of a replanting scheme was prepared by the Department in furtherance of this recommendation.

21. A draft scheme for a fertiliser subsidy in respect of the light soils of the East Coast, where palms benefit considerably from fertiliser use was also prepared.

22. *Fruit*.—There was a further increase in the output of budded fruit trees for distribution although a country-wide shortage of budwood has to some extent limited output.

23. A draft scheme for the replanting of old *dusun* areas of mixed fruits, on an orchard basis of monocrop cultivation, was prepared in furtherance of a recommendation made by a visiting expert under the Colombo Plan.

24. *Pineapple*.—Considerable progress has been made by the Department in the last three years in agronomic work on this crop, more particularly with regard to spacing distance, the use of fertilisers and the use of hormones for controlling fruit production.

25. Arrangements are at present under consideration for the industry to take over this work, employing its own staff for the purpose, and similarly the work on pineapple canning research. This would still leave breeding and selection work and plant protection measures in the hands of the Department.

26. *Food Crops and Vegetables*.—The stabilisation of the agriculture of the New Villages over the past few years, largely assisted by the Department, has resulted in the food crop and vegetable acreage being raised to a figure well above pre-Emergency level. This work is still continuing and its effects are cumulative.

27. *Oil Palm*.—The co-operative scheme for breeding and selection work on this crop, involving the Department and the industry, was continued. A similar scheme, desired by the industry, for co-operation in agronomic investigation work could not be commenced due to shortage of staff in the Department.

28. The Department is still pursuing the possibilities of a smallholders pilot scheme with this crop but, so far, nothing tangible has emerged.

29. *Coffee*.—There has been continuing interest in the cultivation of *Liberica* coffee, primarily on the muck soils of the western coastal belt which are well suited to this crop.

30. *Cacao*.—Further progress was made in determining the agronomic requirements of this crop while soil surveys have disclosed the existence of considerable areas of land in Trengganu and Pahang, well suited to its cultivation. Planting on a commercial basis is, however, still confined to two estates and one pilot scheme for smallholders.

31. *Livestock*.—The value of the Middle White x Chinese pig is now widely appreciated throughout the country and Middle White boars supplied by the Department are everywhere in increasing demand.

32. Pure-bred poultry of a number of breeds are available for distribution at Departmental stations throughout the country although, with the increasing number of commercial poultry farms, the tendency is for the Department to leave supply in the hands of such farms, where their prices are reasonable.

33. Some success has been achieved, in Kelantan particularly, in extending the use of the legume, *Stylosanthes*, as a fodder for cattle, together with the provision of cheaply-erected cattle sheds with the object of producing more cattle manure for use on high-value crops grown in the dry season.

34.—*Soil Surveys*.—There was a further increase in the volume of soil survey work both for specific purposes e.g., new padi areas, land development areas, etc., and in connection with the general soil survey of the country. Much of the work in 1957 was carried out in Kedah and Kelantan.

35. *Agricultural Economic Surveys*.—The field work of the surveys in respect of the northern padi areas was completed during the year and the results are now being compiled. The same applies to the surveys of the coconut areas carried out in West Johore and Kelantan.

36. *College of Agriculture*.—The second of three Schools of Agriculture which are designed to relieve the College of the responsibility for training at Certificate (One year) Course level was opened at Serdang during the year. The first of the three was opened at Telok Chengai, Kedah, in 1956 and the third will be near Kota Bharu, Kelantan. In addition, there will be outlying hostels where special training is necessary, e.g., in the Bagan Datoh area of Perak for coconut work.

37. The provision of these Schools of Agriculture will enable the College to concentrate on the Diploma (Three Year) Course and to provide more accommodation for students wishing to take this Course.

38. *Rural Agricultural Training Centres*.—These are a comparatively recent development but all States now have at least one such centre. They are mostly residential and their main object is the running of practical courses for selected cultivators in improved methods in one or other branch of agriculture, based on the requirements of the trainees and the form of agriculture practised in their particular villages.

F.—GENERAL

39. This will be my last report as Director of Agriculture, following a period of more than 30 years service in Malaya, 21 years in State posts and the remainder at Headquarters, and I would like to take this opportunity of expressing my gratitude for the loyal and enthusiastic support I have invariably received, at all stages in my career, from the staff of all grades, professional and technical, administrative and clerical. The spirit of the Department is good, based as it always has been on team work, and the results it has obtained, particularly in the post-war years, have already exerted and will continue to exert a marked effect in improving the agriculture of the country. The Department does not deal in bricks and mortar and its achievements are thus less easy to assess, and less

visible to the casual beholder as compared with those of the construction Departments, public utilities, etc. Our dealings are with that most human of all beings, the farmer, and possibly it is with him that our stock stands highest. Farmers are conservative people, the whole world over, but there is plenty of evidence in Departmental experience since the war that the Malayan farmer is fully prepared to undertake improvements once he is convinced of their benefit and provided he has the means to adopt them.

40. The Department faces a difficult period over the next few years due to heavy losses of expatriate staff and the comparatively slow rate of replacement by Malaysians. It has a sound organisation, however, and objectives that are clear; furthermore its Malayan staff has been well-trained in all the various grades and although still rather thin on the ground at Division I level, I have every confidence that they will overcome the difficulties that arise and that, after a period of operating necessarily at a much reduced *tempo*, full stature will once again be achieved in its work.

SECTION II

AGRICULTURE

A.—WEATHER

41. The dry weather, which is usually experienced early in the year and coincides with the main padi harvest, was extended this year well into the second and in some localities even to the third quarter and gave rise to drought conditions in Negri Sembilan and the Selangor coastal districts.

42. Elsewhere, however, rainfall was in general seasonal and well distributed.

43. Towards the end of the year, the usual monsoon rains occurred in exceptionally heavy falls in the north-east and east and resulted in severe localised flooding in the riverine *mukim* of Pahang and in the Machang and Pasir Puteh districts of Kelantan.

44. In some coastal areas of Selangor also, considerable damage was caused to dry-land crops by severe and prolonged floods.

B.—CROP REPORTS

(i) RUBBER

45. Comparative acreages under rubber in the Federation are as follows:

Calendar Year	Estates (acres)	Smallholdings (acres)*	Total (acres)*
1951 ..	1,964,000	1,500,000	3,500,000
1952 ..	1,997,000	1,500,000	3,500,000
1953 ..	2,030,000	1,500,000	3,500,000
1954 ..	2,018,000	1,500,000	3,500,000
1955 ..	2,015,000	1,500,000	3,500,000
1956 ..	2,008,000	1,500,000	3,500,000
1957 ..	2,011,000	1,500,000	3,500,000

* Estimates only, no accurate figures being available.

46. Production figures for the Federation are given in the following table:

Calendar Year	Estates (Tons)	Smallholdings (Tons)	Total (Tons)
1951 ..	328,000 ..	275,900 ..	603,900
1952 ..	341,100 ..	241,500 ..	582,600
1953 ..	341,100 ..	231,700 ..	572,800
1954 ..	344,900 ..	240,200 ..	585,100
1955 ..	351,800 ..	285,300 ..	637,100
1956 ..	350,800 ..	273,400 ..	624,200
1957 ..	369,070 ..	268,020 ..	637,100

47. The Pan-Malayan imports and exports of rubber were:

Calendar Year	Gross Exports (Tons)	Gross Imports (Tons)	Net Exports (Tons)
1951 ..	1,155,300 ..	547,100 ..	608,200
1952 ..	910,400 ..	338,900 ..	571,500
1953 ..	847,200 ..	277,500 ..	569,700
1954 ..	915,100 ..	344,200 ..	570,900
1955 ..	994,200 ..	362,300 ..	631,900
1956 ..	983,300 ..	365,800 ..	617,500
1957 ..	1,002,200 ..	363,300 ..	638,900

48. Rubber prices for R.S.S. 1 were generally good during the first three quarters of the year averaging 92.55, 91.44 and 89.96 cents per lb during the first, second and third quarters but dropped to 81.15 cents per lb during the fourth quarter. The overall average was 88.75 cents compared with 96.76 in 1956 and 114.16 in 1955.

49. Subdivision of large estates resulted in a considerable volume of publicity and a committee of enquiry was set up to study its effects. The committee submitted its report late in the year. The main findings were that subdivision, except in Province Wellesley had not assumed any great degree of magnitude and it was recommended that although the situation should be watched carefully, no immediate action needed to be taken to counter such subdivision.

50. The figures for production from smallholders are at best only estimates, but the lower production during 1957 was due partly to the drop in the price of rubber and partly to replanting. The fall in production in 1957 was 5,376 tons as compared with 11,900 tons in 1956.

51. Rubber in Malaya is generally marketed in the form of Ribbed Smoked Sheet (R.S.S.), Crepe and Preserved Latex. Small quantities of specialised types such as Rubber Powder and Cyclised Rubber are also produced. Approximately 59 per cent of the rubber in the Federation was exported in the form of ribbed smoked sheet, 30 per cent as crepes of various types and 11 per cent as preserved latex.

52. Latex marketing schemes, introduced with the dual purpose of improving the quality of the rubber produced by smallholders and of increasing the value to the smallholder of his crop, have unfortunately not in practice fulfilled their early promise and have, with few exceptions, made little or no headway in the last few years.

53. The following schemes to assist the rubber industry are now in operation :

- (1) Rubber Replanting Scheme A for estates; this offers assistance at the rate of \$400 per acre.
- (2) Rubber Replanting Scheme B for smallholders which offers assistance at the rate of \$600 per acre.
- (3) Rubber Industry (Replanting) Scheme which allows smallholders with five acres or less who own old rubber land and land not yet planted, to new-plant on one area to the equivalent acreage of his present rubber holding. When the new trees come into bearing the trees in the old holding must be cut out. A grant of \$500 per acre is given in assistance.
- (4) Rubber Industry (Smallholder New Planting) Scheme. This is a new scheme which was finalised at the end of the year. It provides assistance at the rate of \$400 per acre to selected block new planting schemes in which individual participants plant not less than six acres of rubber.

54. Schemes (2) and (3) are the concern of the Administrators of Fund "B" of the Rubber Replanting Scheme, under whose direction the Smallholders' Replanting Organisation functions. The aim of Scheme (2) is to replant a total of 500,000 acres of smallholding rubber in seven years from the date of the Scheme's inception. Of necessity, having regard to the need for staff recruitment and training, as well as for publicity in the early stages, the annual target for replanting was graded, commencing with 40,000 acres in the first year and ending with 90,000 acres in the final year. The whole undertaking is a most formidable one and there are few, if any, schemes elsewhere in tropical agriculture of equal magnitude and importance.

55. The replanting target for 1957 was 80,000 acres and again was not reached. Of 19,206 applicants who wished to replant rubber on 82,660 acres, only 15,454 holding 63,242 acres, fulfilled the stipulated conditions and received the necessary approval. By the end of December 10,228 of the approved applicants, with a total of 37,780 acres, had received the first cash grant which is payable when felling, clearing, lining and holing are completed and authority given to commence planting. The comparable figures for 1956 are 11,393 approved applicants and 36,843 acres by the end of that year.

56. When conditions are suitable, encouragement is given to replant with approved crops other than rubber, the same amount of grant being paid as for rubber. This policy resulted in 1957 in 2,038 smallholders applying to plant with other crops. Out of these 1,602 applicants with 4,412 acres were accepted, as compared with 1,241 applicants (3,656 acres) in 1956.

57. From the date of commencement of the scheme, 166,850 acres have been replanted with high yielding rubber and 14,000 acres with approved alternative crops. The latter has

comprised fruit 3,700 acres, coconuts 3,600 acres, coffee 2,000 acres, padi 1,700 acres, pineapples 2,400 acres and sago 480 acres. In addition 6,750 acres were replanted with rubber and 360 acres with crops other than rubber as excess replanting and not qualifying for a grant, giving a total area replanted since the inception of the scheme of 188,000 acres. At the end of 1957 the total financial outlay amounted to approximately \$48,850,000.

58. A high standard of maintenance in replanted holdings is exacted and cash grants may be withheld if maintenance is found to be sub-standard. In regard to lalang (*Imperata cylindrica*) in particular, full and complete eradication is demanded on the grounds that once this weed becomes firmly established, not only will the replanted rubber be several years late in coming into bearing but yields may be permanently impaired and the advantage accruing from the use of high yielding material very greatly reduced.

59. Illegal planting of smallholdings in recent years has assumed major proportion in some States—mainly in Kedah, Perlis and parts of Johore. Unfortunately, much of this planting has been with unselected seedlings. This is a serious state of affairs, since it means that Malaya is losing much of its potential crop and is thus placed in a less favourable position to meet any severe outside competition. In addition the illegal planter is in many cases developing an uneconomic holding and may not be able to face lower prices.

60. Practically all States have reported a continuance of applications for new planting, partly as the result of the easing of the Emergency and in spite of the gradual fall in rubber prices. While there are bound to be delays before actual planting takes place, there is little doubt that the next few years will see a considerable increase in the smallholder acreage under rubber. In Johore, Kedah, Kelantan and Pahang, where much of the new planting occurs, active steps are being taken to organise new planting and to ensure that only high yielding planting material is used. This is being actively encouraged by the recently formed Federal Land Development Authority and through the new planting scheme. The Federal Land Development Authority so far has only one scheme under way, that at Ayer Lanas in Kelantan. It is proposed under this scheme to plant some 2,400 acres with rubber, and 1,600 acres with padi and kampong crops, in the first instance.

61. In order to protect the interests of the smallholder, it was necessary in October, 1956, to impose a ban on the export of Tjir.1 clonal seed from Malaya. During past years, a considerable trade in the export of clonal seed from Malaya has been built up; this trade had developed to such an extent that there was a grave danger of not obtaining sufficient seed for the needs of the smallholders. The ban had the desired effect and enabled the authorities responsible for the supply of planting material to obtain 85 per cent of its seed requirements by the end of December, 1957.

(ii) RICE

62. Production, with the exception of the padi grown at Changkat Jong, Perak, and a part of Tanjong Karang, Selangor, is almost entirely in the hands of the Malays, while milling and marketing are mainly organised by the Chinese.

63. The 1956-57 season saw an increase of some 16,180 acres in the acreage planted with wet padi. This increase was due mainly to good weather conditions in the main padi areas of the north, and partly to the normal revival of interest in padi planting outside the main padi areas as a result of a decline in rubber prices. The area under dry padi continued to increase slightly, due to new areas being developed for rubber.

64. The 1956-57 wet padi crop was an all-time record, amounting to 774,020 tons; this, together with the production of dry padi, was estimated to be sufficient to meet nearly 60 per cent of the Federation's requirement. This happy state of affairs can be attributed to three factors: firstly, the excellent weather conditions during the season; secondly, to the increase in acreage and thirdly, and probably the most significant and important, to the fact that the results of long term improvement measures are at last beginning to take effect.

65. The following figures show the improvement in yield per acre over the past 30 years.

Season	Average Yield in gantangs per acre
1926-27	207
1931-32	291
1936-37	297
1940-41	275
1946-47	222
1951-52	277
1953-54	324
1956-57	358

66. Estimates of the acreage of wet padi planted in the 1957-58 season show an increase of approximately 9,000 acres, again reflecting the upward trend of interest in padi following a fall in rubber prices. The 1957-58 padi season has been extremely promising and a good crop is expected to be harvested.

67. The following table gives comparative figures for acreages under wet and dry padi, together with yields, since 1950:

Season	Wet Padi		Dry Padi		Total Padi	
	Acreage (Planted)	Yield (Tons)	Acreage (Planted)	Yield (Tons)	Acreage (Planted)	Yield (Tons)
1950-51	829,000	685,000	47,000	18,000	876,000	703,000
1951-52	790,000	526,000	41,000	16,000	831,000	542,000
1952-53	790,000	684,000	44,000	16,000	834,000	700,000
1953-54	809,000	635,000	37,000	13,000	846,000	648,000
1954-55	843,000	633,000	48,000	19,000	891,000	652,000
1955-56	825,000	644,100	51,000	23,000	876,000	667,000
1956-57	841,000	746,000	55,000	28,000	896,000	774,000
1957-58	850,000	—	50,000	—	900,000	—

68. Dry padi in this country is grown under two entirely different sets of conditions, either in semi-wet soil, as in Kelantan and Trengganu (Padi Tugalan, Padi Taboran or Padi Tenggalan) now known as lowland dry padi; or in dry soil as hill padi, now classified as upland dry padi.

69. The acreage under lowland dry padi varies considerably from year to year, depending largely upon the time of arrival of the rains, i.e., if the rains are late a greater area is planted with lowland dry padi, but if early, more of the land is planted with wet padi.

70. Since the middle of 1956, more accurate statistics have been kept of the two types of dry padi. The relative figures for areas planted in the 1956-57 season are upland dry padi, 13,330 acres, and lowland dry padi, 41,790 acres; for the 1957-58 season the respective figures are approximately 16,750 and 33,250 acres.

71. A total area of 7,300 acres was double-cropped with wet padi during 1957. This is a decrease of 1,710 acres over the 1956 figure but is a little better than the 1955 figure of 6,361 acres. The drop in acreage was due to the abnormally dry weather during the early part of the year, resulting in an inadequate off-season water supply. Although the acreage was lower, production was well maintained, the average yield in 1957 being 373 gantangs per acre as compared with 341 gantangs in 1956. The corresponding figure for 1955 was 239 gantangs per acre.

72. The only areas in the Federation at present being double-cropped with wet padi are the Sg. Dua area in Province Wellesley and around Yen in Kedah. In the Sg. Dua area double-cropping has been practised since the time of the Japanese occupation and is gaining in popularity. Double-cropping in most parts of the Federation is at present technically not possible with existing irrigation schemes or in the absence of irrigation.

73. In the 1956 report, attention was drawn to the fact that the padi yields in the Federation were the highest in South East Asia. The Department of Agriculture can claim some of the credit for raising the padi yields in the country through its efforts in selecting and distributing high yielding varieties, the initiation of more efficient pest and disease control measures and its work on the manurial requirements of the crop.

74. It is known that individual farmers in the Federation often obtain extremely high yields. Probably one of the highest yields ever obtained in the Federation was that of a Chinese farmer in Sekinchang, Selangor, who reaped 1,148 gantangs per acre from his holding and later collected an additional 200 gantangs per acre from the regrowth.

75. The average price of imported Siam rice (new crop) in 1957 was about 43 cents per pikul lower than in 1956. The Government guaranteed minimum or support price for locally grown padi remained at \$15 per pikul for the 1956-57 season. The easing of tension in international affairs and the existence

of substantial rice stocks surplus to world requirements are not accepted as grounds for reducing output in Malaya, and intensification of local production by opening up potential new areas and improving existing areas, the extended use of high yielding strains and fertilisers and the introduction of improved field techniques, still remains the policy of the Government.

76. In late 1955 the Kedah Government, in a determined effort to bring about some permanent improvement in the living standard of their padi cultivators, set up a Padi Planters Board and a Padi Planters Association.

77. The defined objects of the Board are:

- (a) to assist in the working of any association of padi planters approved by the Ruler in Council and if it thinks fit to provide financial assistance in ways approved by the Ruler in Council to the said association;
- (b) to purchase padi land for resale, mortgage or rent to padi planters; and
- (c) to make proposals for schemes for the benefit of padi planters and to give effect to such of the said schemes as the Ruler in Council may approve as being for the benefit of padi planters, either collectively or individually.

78. The main object of the Association is to unite all padi planters in Kedah in an organised body in order to improve their economic status and protect their interests.

79. In order to achieve these objectives, the members of the Association pledge—

- (a) To work in co-operation with the Padi Planters Board.
- (b) To co-operate with all the technical Departments concerned with the padi industry.
- (c) To establish libraries for members.
- (d) To organise youth and womens' movements, etc.

80. The main activities of the Board have been to redeem 1,558 acres of land held under *jual janji* (mortgage) at a cost of \$631,338, 1,292 acres held under *gadaian* (usufructuary loan) at a cost of \$475,519 and to purchase and resell or rent to members of the Association 668 acres at a cost of \$549,249.

81. By the end of the year the Padi Planters Association consisted of 18 divisions with 222 branches, with a total registered membership of 42,726 as compared with 216 branches and 34,511 members in 1956.

82. Under Malayan conditions, padi suffers comparatively little from diseases, an unidentified complex known as *penyakit merah* being probably the most important. This was not very much in evidence during the 1955-56 season. Pests, on the other hand, particularly stem-borers and to a lesser extent rats, cause considerable damage to crops from time to time and there is scope for the expansion of organised pest control measures.

83. A subsidised fertiliser scheme was in operation in Kelantan for the sixth year in succession. Although the price paid by the farmers was the highest yet (\$10 per bag of 100 lb.), sales proved to be far higher than in previous seasons, much of the credit for which is due to the efforts of the Field Branch of the Department in Kelantan. By the end of the year 31,333 bags had been sold, as compared with 18,309 in 1956, 19,967 in 1955, and 6,626 bags in 1954. If all farmers in the State applied manure at 200 lb. per acre once in three years, approximately 95,500 bags would be required annually.

84. In Trengganu, a new State-wide Subsidy Scheme was introduced. The cultivator paid only 50 per cent of the cost price, which in practice worked out at \$7.10 per bag of 100 lb at the beginning of the season and \$6.55 in November and December, as the fertiliser price dropped from \$14.20 to \$13.10 per 100 lb. bag. Altogether 8,321 bags were sold—sufficient for 4,160 acres or nine per cent of the total area planted.

85. In Malacca, subsidised fertilisers were distributed on payment of \$20 per acre. In spite of the change from the previous arrangement of a down-payment of \$10 and \$10 after harvest, the amount of fertiliser distributed was almost as much as in the previous season, viz. 3,960 bags, as compared with 4,618 bags in 1956/57 season. This was sufficient for 990 acres as compared with 1,150 acres in the previous season.

86. In Negri Sembilan the Subsidy Scheme launched in 1956 was continued and was much more successful, due to the very good response obtained in the 1956/57 season. In all, approximately 4,900 bags of 100 lb. were sold, sufficient to treat 1,834 acres, as compared with 600 acres in the previous season.

87. All these schemes were financed from the grant of \$10 million by the Federal Government to assist padi planters.

88. Although there are no subsidized schemes in other States, in Kedah and Perlis the usual fertiliser is bat guano and large quantities of it are used annually. Rock phosphate is slowly gaining in popularity in Penang, Province Wellesley and in parts of Perak and bone meal is used in Malacca at transplanting time. Nursery manuring is also gaining in popularity.

89. On the whole, there is little doubt that padi cultivators are slowly becoming fertiliser-conscious and there is a need for a Federation-wide subsidy scheme.

90. Post-war botanical research and agronomic investigations have progressed sufficiently far to permit the extensive demonstration on farmers' land of new padi selections and improved strains, as well as improved techniques of planting and the use of fertilisers. Selected padi varieties are now being grown and issued on a commercial scale in Malacca and Negri Sembilan.

91. Soil sampling of the Kedah Plain to determine its fertiliser requirements was taken a stage further in 1957 but will not be completed until 1960. The slow rate of progress is due to the very short period available for work while the land is dry between padi seasons.

92. The problems of rice mechanisation up to the stage of planting have largely been solved, but those relating to planting and harvesting still present difficulties. The mechanisation pilot scheme in the Trans-Perak area has run into numerous difficulties, mainly in connection with the inadequate supply of irrigation water.

93. Data in regard to annual Pan-Malayan retained imports of rice and costs are given in the following table:

NET IMPORTS OF RICE
(Pan-Malayan)

Year		Tons		Value in \$
1951	..	499,000	..	218,740,000
1952	..	423,000	..	198,886,000
1953	..	494,000	..	271,079,000
1954	..	268,000	..	124,812,000
1955	..	484,000	..	164,031,000
1956	..	503,000	..	179,307,000
1957	..	404,000	..	151,583,000

(iii) OIL PALM

94. Oil palm cultivation in Malaya is confined wholly to estates, but with organised central processing it could equally well become a smallholders' crop.

95. Details of acreage planted and the production of oil and kernels are as follows:

Year		Planted Acreage		Palm Oil (Tons)		Palm Kernels (Tons)
1951	..	97,000	..	48,000	..	12,000
1952	..	100,000	..	45,000	..	11,000
1953	..	108,000	..	49,000	..	13,000
1954	..	109,000	..	54,000	..	14,000
1955	..	111,000	..	56,000	..	15,000
1956	..	115,000	..	56,000	..	14,000
1957	..	116,000	..	58,500	..	15,000

96. The London quoted average price for palm oil for 1957 was £83.8 per ton, £0.4 per ton higher than the 1956 price.

(iv) COCONUT

97. The main coconut areas in the Federation are the west coastal area of Johore, the Selangor coastal area, the Bagan Datoh peninsula in Perak and the coastal area of Province Wellesley. Coconuts are also extensively grown along the east coast.

98. Coconuts are planted in both pure and mixed stands and come next in importance to rice and rubber as smallholders' crops. The acreage under smallholdings remains very constant from year to year. The coastal alluvial clays of the west coast have proved eminently suitable for coconut growing and, where drainage and general husbandry are of high standard, average yields of up to 1,600 lb of copra per acre are not uncommon.

PRODUCTION (TONS)

FEDERATION OF MALAYA

Year	COPRA		Coconut oil	Copra cake
	Estates	Smallholdings		
1953 ..	40,000	112,000 ..	79,000 ..	50,000
1954 ..	40,000	124,000 ..	97,000 ..	62,000
1955 ..	40,000	104,000 ..	95,000 ..	60,000
1956 ..	39,000	115,000 ..	108,000 ..	68,000
1957 ..	36,000	94,000 ..	97,000 ..	61,000

99. At the end of 1957 there were some 95 estates in the Federation with a total of about 85,561 acres. These estates range in size from 100 to over 3,000 acres.

100. Since the war owing to shortage of local supplies, oil millers have built up a considerable trade in importing copra from neighbouring territories and this has resulted in the Pan-Malayan trade figures for copra showing an adverse trade balance, with gross imports exceeding gross exports, as shown in the following table:

NET IMPORTS OF COPRA

Year	Tons	Value
		\$
1951 ..	11,000 ..	6,606,000
1952 ..	28,000 ..	4,501,000
1953 ..	10,000 ..	2,085,000
1954 ..	67,000 ..	23,446,000
1955 ..	75,000 ..	24,446,000
1956 ..	83,000 ..	29,051,000
1957 ..	72,000 ..	25,517,000

101. The coconut oil industry, however, has expanded steadily and net exports have risen as follows:

NET EXPORTS OF COCONUT OIL

Year	Tons	Value
		\$
1951 ..	68,000 ..	87,508,000
1952 ..	65,000 ..	53,966,000
1953 ..	61,000 ..	58,033,000
1954 ..	79,000 ..	74,719,000
1955 ..	91,000 ..	67,554,000
1956 ..	103,000 ..	73,318,000
1957 ..	100,000 ..	75,473,000

102. The production of copra for export or for local extraction of oil is the main market interest, but there is also a fairly considerable trade in fresh nuts for home consumption. Estate-produced copra, the result of a carefully controlled process, is of high quality but the small-holding product is generally of poor quality owing to primitive methods of drying. There is, however, little or no incentive to smallholders to improve the quality of their produce, as the buyers do not recognise grades, nor are they prepared to offer a premium price for high quality.

103. Extensive drainage work on the west coast of Johore continues and the prospects of the smallholders in that area are slowly improving. Elsewhere the industry appears to be static, with perhaps a slight tendency to a decline in yield due to the old age of the palms and a lack of any organised replanting.

104. The Working Committee set up last year to collect and review existing agricultural and economic data on the coconut industry and to make recommendations for the improvement and development of the industry, completed its work during the year and presented its report to Government. One of its recommendations was in respect of a pilot replanting scheme in Johore.

105. The Rhinoceros Beetle, *Oryctes rhinoceros*, is Malaya's worst potential coconut pest whose incidence, despite widespread propaganda, appears to be increasing. This is explained by the fact that the beetle has been found to breed extensively in felled rubber, and with rubber replanting now being conducted on such an extensive scale it is difficult to exercise the required amount of control to deny this breeding ground to the beetle.

106. An unidentified disease has been discovered in Johore, the extent and magnitude of which is not yet known, but a preliminary survey has been completed and is being followed up.

(v) PINEAPPLE

107. Pineapples are grown throughout Malaya, but only in three States are they cultivated for canning. In the post-war rehabilitation of the industry, emphasis has been laid on permanent plantations in contrast to the catch-crop system employed before the war. That a crop of such economic importance as the pineapple can be successfully grown on deep peat is indeed a fortunate occurrence and present policy therefore is to restrict sole cropping to the peat areas, of which there are large reserves.

108. The area under pineapples on both estates and smallholdings is steadily increasing both for canning purposes as well as for the fresh fruit trade. Large scale clearing of jungle, extensive drainage works and planting were in progress during the year in Johore and to a lesser extent in Selangor and Perak.

109. The total acreages under cultivation during the past four years are as follows:

1953	1954	1955	1956	1957
23,930 ..	27,950 ..	34,850 ..	44,780 ..	45,550

110. Of these totals, the acreages devoted to pineapples grown for canning are:

	1953	1954	1955	1956	1957
Estates	8,656	8,976	13,876	19,062	19,616
Smallholders ..	10,499	12,106	16,499	18,974	17,000*

111. The industry, through the Pineapple Joint Industrial Council, finances the annual programme of experiments which is pursued at the Pineapple Stations in Johore and Selangor by the

* Estimate only.

Department of Agriculture. The Pineapple Joint Industrial Council was dissolved during the year and replaced by the Pineapple Industry Board, a largely self-governing body.

112. A total of 287 million lb of fruit was received by the canneries during the year as compared with 274 million lb in 1956. Out of this figure, smallholders produced 120 million lb and estates 166 million lb. Johore production totalled 266 million lb, Selangor 15 million lb and Perak 6 million lb.

113. Improved husbandry is playing a very important part in improving yields and in raising the standard of industry. This is most essential if Malayan pineapples are to hold their place in world markets and in view of the ever growing competition from other countries.

114. Exports of canned pineapples from the Federation amounted to 25,960 tons in 1957 as compared with 22,275 tons in 1956, 20,121 tons in 1955 and 16,236 tons in 1954.

115. The industry passed through a very difficult time during the year as the result of the very poor sales of canned pines to the United Kingdom, due to increased competition from other producing countries. This resulted in large stocks of canned pines having to be held at local canneries and a general reluctance to continue production at the normal rate. In order to attempt to clear stocks prices were reduced. This automatically involved the small growers and resulted in considerable hardship to them. After much discussion a temporary solution was found, but smallgrowers continued to be dissatisfied at the high rate of rejection of their fruit by canners.

(vi) CACAO

116. The prospects of cacao as a potential economic crop for Malaya are good, especially on the better types of soil in Pahang and Trengganu, and the progress so far achieved has been followed with interest in the country. Both Trengganu and Pahang have earmarked blocks of State land for future development with this crop.

117. The smallholders pilot scheme in Trengganu has made reasonably good progress. The scheme got away to a good start and the whole of the 48 acres target were planted with cacao by the end of the year, the 12 smallholders proving to be keen and industrious. Further pilot schemes in Trengganu and Pahang were still under consideration at the end of the year.

118. There are five estates in the Federation planting cacao on a commercial scale. Two of these are in Trengganu, with a total area of 856 acres of cacao as a sole crop under thinned jungle, and three are in Lower Perak, with 225 acres of cacao as a secondary crop under coconuts.

119. Tree shrews, rats and squirrels have all been troublesome, even on small, well-protected holdings, and it remains to be seen, once extensive planting is undertaken, whether or not pest control will prove excessively costly. The present indications are that it will not be so.

(vii) TEA

120. Both lowland and highland teas are grown commercially in Malaya and although the former may be of lower quality its greater yield per acre, almost double that for highland tea, more than offsets the disadvantages of a slightly lower market price. On well-managed highland estates, crops of 800 lb. of made tea per acre are obtained. Clean weeding, despite publicity with regard to erosion dangers, is still practised by some growers.

121. Tea prices in 1957 have remained at a high level, causing the crop, temporarily at least, to be one of the most profitable to grow. Two lowland estates continued to extend their planted acreage. Malayan tea of all grades was sold at about \$2.60 per lb. on the London market while the local price for Highland tea was about \$2.80 per lb. retail.

122. In the Highlands, the anticipated increased incidence of Blister Blight (*Exobasidium vexans*) during the wet months of November and December was effectively controlled by the use of copper fungicides. This disease, although also recorded in the low lands, does no serious damage there.

123. Production figures of dried tea are as follows :

Year	Production (lb.)	Exports of Local Tea* (lb.)
1952 ..	2,785,000 ..	1,752,000
1953 ..	4,187,000 ..	2,172,000
1954 ..	4,590,000 ..	2,757,000
1955 ..	5,306,000 ..	2,864,000
1956 ..	5,023,000 ..	3,633,000
1957 ..	5,247,000 ..	3,934,000

(viii) FOOD CROPS, VEGETABLES AND FRUIT

124. The acreage under food crops increased from 101,700 acres at the end of 1956 to 106,531 acres at the end of 1957. The main rice-substitute crops were sweet potato, tapioca and yams. Tapioca was also extensively grown for the production of starch. During the annual fallow it is customary in the east coast States of Kelantan and Trengganu and in Kedah, Penang, Selangor and Malacca, to cultivate small selected areas of the rice fields with crops such as groundnuts, maize, beans, chilli, cucumber and Chinese radish.

125. The considerable areas of intensively cultivated market gardens which exists mainly for the production of leafy vegetables—chiefly lettuce and mustard—were maintained. In Cameron Highlands about 1,200 acres were under vegetables.

126. Water melons continued to be an important seasonal crop in the northern States experiencing monsoon conditions.

127. Bananas were again favoured as a catch-crop in new-planted and replanted rubber; however, the planted acreage showed a decrease of 5,600 acres over that of 1956.

*In addition to these quantities, a small amount of Malayan tea is mixed with foreign teas and then exported.

128. Fruit trees in mixed stands are a feature of every kampong and the total area throughout the country is estimated at 110,860 acres (excluding bananas).

129. The Department of Agriculture's selected fruit clones are popular among small fruit growers and the production and distribution of large numbers of improved fruit planting material is an important Departmental undertaking.

130. The fruit harvest was generally good and in some areas a glut of fruit occurred. Mr. H. V. Smith, a Colombo Plan expert, visited the country and reported on the fruit industry, with special reference to its marketing problems.

(ix) COFFEE

131. Coffee is essentially a smallholders' crop in Malaya, there being only one estate, and present production is insufficient to meet local requirements. The price for *Liberica* coffee, which is the only planted variety of importance, stood at \$130 to \$145 per pikul when the mid-year crop came on to the market. Later on, prices strengthened to \$155 per pikul, at which price gross returns per acre average about \$870. Interest in this crop is well maintained and the planted area increased in 1957 to 14,210 acres, an increase of 1,130 acres over the 1956 figure.

(x) SPICES

132. Only arecanuts and pepper are of importance as export crops. Other spices such as chillies, ginger, turmeric, sireh, nutmegs and cloves, are all cultivated on a small scale and largely for the internal market.

(xi) TOBACCO

133. Tobacco is an important cash crop usually grown in rotation with market garden vegetables, or as an off-season crop in padi areas. Although the leaf is coarse in quality, it meets with a ready sale for the manufacture of cut tobacco and cheroots. The area planted was estimated at 4,000 acres in 1956 and 6,000 acres were harvested in 1957.

(xii) MISCELLANEOUS CROPS

134. Other crops of minor importance which are grown are derris, gambier, kapok, patchouli, citronella, sugar palm, nipah palm, sago, groundnuts, maize, yams and pulses.

C.—STOCK

(i) CATTLE, BUFFALOES, GOATS AND SHEEP

135. Livestock, although an important capital asset in smallholding agriculture, are raised and maintained with the minimum of trouble to the owner and mixed farming, in the generally accepted sense, is little practised. In the main padi-growing States, buffaloes and cattle are primarily used as draught animals, the production of meat and milk being of secondary importance. In certain States, extensive areas are set

aside as communal grazing grounds, but for the most part they are infrequently used and are not well maintained. Seldom, if ever, are concentrates fed. Milk production on a small scale is conducted by Indians in the vicinity of the larger towns.

136. Sheep are found in the drier east coast areas though not in large numbers. Goats are kept in most areas.

(ii) PIGS

137. The prices of feeding stuffs remained high. The use of Middle White boars for crossing with the local sows is now a well-established practice in all the major pig-rearing areas.

(iii) POULTRY

138. A considerable trade continued in poultry and eggs. There are a number of small-scale poultry rearers both in rural and urban areas whose needs in the way of breeding stock and eggs for hatching were met mainly by the commercial poultry farms. These commercial poultry farms are highly organised undertakings which rear both local and imported breeds. The Rhode Island Red and White Leghorn remain the most popular of the imported breeds. It is no longer the Department of Agriculture's policy to recommend the use of imported breeds in rural areas, owing to the necessity for specialised feeding and housing.

139. In the urban areas the number of specialised farms which keep birds under battery or deep litter systems is slowly increasing.

SECTION III

DEPARTMENT OF AGRICULTURE ORGANISATION AND ESTABLISHMENT

A.—ESTABLISHMENT

140. The establishment of the Department is shown at Table I. The number of posts for Professional Officers is 64. In establishment posts, there were 19 vacancies at the close of the year, made up as follows:

Senior Entomologist	...	...	...	...	1
Entomologist	...	...	...	...	1
Botanist	...	...	...	...	1
Chemists	...	...	...	...	2
Canning Officer	...	...	...	...	1
Statistician	...	...	...	...	1
Principal, College of Agriculture	...	...	...	...	1
Publications Officer	...	...	...	...	1
Agricultural Officers	...	...	...	...	4
Agonomists	...	...	...	...	5
Horticultural Officer	...	...	...	...	1

TABLE I

DEPARTMENT OF AGRICULTURE, 1957

ORGANISATION AND ESTABLISHMENT BY BRANCHES (EXCLUDING MINOR NON-TECHNICAL POSTS)

DIRECTOR					
DEPUTY DIRECTOR					
RESEARCH BRANCH	AGRONOMY BRANCH	FIELD BRANCH	PUBLICATIONS BRANCH	EDUCATION BRANCH	ADMINISTRATION
1 Assistant Director (Research) 1 Executive Officer 5 Heads of Division: 2 Senior Research Officers, Grade A 3 Senior Research Officers, Grade B	1 Senior Agronomist	1 Assistant Director (Field) 1 Personal Assistant 5 Senior Agricultural Officers, Grade A 1 Senior Agricultural Officer, Grade B 14 Agricultural Officers 1 Agricultural Economist	1 Publications Officer 1 Librarian	1 Principal, College of Agriculture 2 Senior Lecturers 1 Registrar and Bursar	1 Administrative Officer 1 Executive Officer 1 Financial Assistant
14 Other Senior Officers	13 Other Senior Officers			9 Agricultural Assistant Service Scheme Posts	
1 Assistant Chemist 22 Agricultural Assistant Service Scheme Posts 53 Junior Agricultural Assistant Service Scheme Posts 23 Miscellaneous Junior Technical Posts 120 Posts	5 Non-Professional Senior Officers 1 Assistant Statistician 12 Agricultural Assistants 37 Junior Agricultural Assistants 8 Miscellaneous Junior Technical Posts 77 Posts	108 Agricultural Assistant Service Scheme Posts 213 Junior Agricultural Assistant Service Scheme Posts	3 Miscellaneous Junior Technical Posts 3 Posts	6 Miscellaneous Junior Posts 19 Posts	27 Miscellaneous Clerical Posts 30 Posts
344 Posts					

B.—SENIOR STAFF CHANGES

(i) BRANCH HEAD POSTS

141. (a) *Head Office (Administration)*.—Mr. H. J. Simpson, P.J.K., Assistant Director (Field) acted as Deputy Director of Agriculture from 7th November, 1956. He was promoted Deputy Director of Agriculture with effect from 8th May, 1957.

142. (b) *Field Branch*.—Mr. E. F. Allen, Senior Agronomist, acted as Assistant Director (Field) until his promotion to this post on 8th May, 1957.

143. Mr. T. R. Dickinson, Agricultural Officer, assumed duty as Acting Senior Agricultural Officer, Grade A (State Agricultural Officer, Perak) with effect from 18th April, 1957.

144. Mr. J. L. B. Hitchcock, Senior Agricultural Officer, Grade B, assumed duty as Acting Senior Agricultural Officer, Grade A (State Agricultural Officer, Kelantan) with effect from 6th June, 1957.

145. Mr. P. Class, Agricultural Officer, was appointed Acting Senior Agricultural Officer, Grade B (State Agricultural Officer, Pahang) with effect from 3rd April, 1957.

146. (c) *Research Branch*.—Mr. J. K. Coulter, Senior Research Officer, Grade A, assumed duty as acting Assistant Director (Research) with effect from 1st December, 1957, vice Mr. L. N. H. Larter who proceeded on leave prior to retirement.

147. Mr. A. R. McWalter, Soils Chemist, assumed duty as Senior Research Officer, Grade A, with effect from 1st December, 1957, vice Mr. J. K. Coulter, Acting Assistant Director (Research).

148. Mr. G. W. Arnott, Soils Chemist, assumed duty as Acting Senior Research Officer, Grade B (Senior Chemist) with effect from 15th October, 1957, vice Mr. F. N. G. Conaty, who proceeded on leave.

149. Mr. A. V. Haddon, Botanist, assumed duty as Acting Senior Botanist with effect from 26th August, 1957, vice Mr. F. B. Brown, who proceeded on leave.

150. (d) *Education Branch*.—Mr. Chew Hong Jung, Botanist, assumed duty as Acting Principal, College of Agriculture, with effect from 11th June, 1957.

151. (e) *Agronomy Branch*.—Mr. R. Henderson, M.C., Senior Agricultural Officer, Grade A, continued to act as Senior Agronomist during 1957.

(ii) RECRUITMENT

152. Wan Mohamed Don bin Mohamed, B.Sc. was appointed Pupil Agricultural Officer with effect from 7th November, 1957.

153. Mr. A. Santiago, B.Sc. M.Sc., was appointed Botanist, (Plant Breeder) on probation with effect from 3rd December, 1957.

(iii) RETIREMENTS

154. The following officers retired during the year :

- (1) Mr. W. N. Scott, B.Sc., B. Agr., Ph.D., D.I.C., Senior Agricultural Officer, Grade A, with effect from 5th September, 1957.
- (2) Mr. P. A. Gething, M.A., Dip. Agr. Sci. (Cantab.), A.I.C.T.A., Senior Agricultural Officer, Grade A, with effect from 2nd July, 1957.
- (3) Mr. H. M. James, M.C., Dip. Agri. (I.C.T.A.), Senior Agricultural Officer, Grade A, with effect from 13th October, 1957.
- (4) Mr. O. M. Lee, M.I. Biol., A.I. Mech. E., F.L.S., F.G.S., Principal, College of Agriculture, with effect from 4th November, 1957.
- (5) Mr. I. J. Wyatt, B.Sc. (Hons.), Dip. Agri. Sci. (Cantab.), D.T.A., Entomologist, with effect from 2nd July, 1957.
- (6) Mr. M. J. Strickland, M.A., D.T.A., Agronomist, with effect from 18th October, 1957.
- (7) Mr. H. K. Ashby, B.A. (Hons.), Dip. Agr. Sci., A.I.C.T.A., Senior Agricultural Officer, Grade A, with effect from 2nd July, 1957.
- (8) Mr. H. Ritchings, Dip. Hort. Ins., Horticultural Officer, with effect from 1st October, 1957.
- (9) Dr. C. C. Webster, Ph.D., B.Sc. (Agric.), Dip. Agric. (Wye), Deputy Director of Agriculture, with effect from 27th October, 1957.
- (10) Mr. D. L. Stacey, B.S.A. (U.B.C.). 1953, Agronomist, with effect from 1st January, 1957.
- (11) Mr. A. E. Billington, M.A., A.R.I.C., Senior Research Officer, Grade A, with effect from 2nd July, 1957.

(iv) PROMOTIONS

155. Mr. H. J. Simpson, P.J.K., Assistant Director (Field) was promoted to the post of Deputy Director of Agriculture, with effect from 8th May, 1957.

156. Mr. E. F. Allen, M.A., Dip. Agric. Sci. (Cantab.), A.I.C.T.A., Senior Agronomist, was promoted to the post of Assistant Director (Field), with effect from 8th May, 1957.

157. Mr. A. Johnston, Senior Research Officer, Grade B, was promoted to Senior Research Officer, Grade A, with effect from 2nd July, 1957.

158. Mr. F. N. G. Conaty, Canning Officer, was promoted to Senior Research Officer, Grade B, with effect from 2nd July, 1957.

159. Mr. R. Henderson, M.C., Senior Agricultural Officer, Grade B, was promoted to Senior Agricultural Officer, Grade A, with effect from 8th May, 1957.

160. Mr. A. L. Barcroft, Agricultural Officer, was promoted to Senior Agricultural Officer, Grade B, with effect from 8th May, 1957, and to Senior Agricultural Officer, Grade A, with effect from 2nd July, 1957.

161. Mr. J. K. Coulter, Senior Research Officer, Grade B, was promoted to Senior Research Officer, Grade A, with effect from 14th January, 1956 (antedated). Promotion notified in 1957 only.

162. Mr. G. S. Keeping, Agricultural Officer, was promoted to Senior Agricultural Officer, Grade B, with effect from 2nd July, 1957, and to Senior Agricultural Officer, Grade A, with effect from 5th September, 1957.

163. Mr. H. D. Matheson, Agricultural Officer, was promoted to Senior Agricultural Officer, Grade B, with effect from 5th September, 1957, and to Senior Agricultural Officer, Grade A, with effect from 13th October, 1957.

164. Mr. J. L. B. Hitchcock, Agricultural Officer, was promoted to Senior Agricultural Officer, Grade B, with effect from 5th September, 1957, and Senior Agricultural Officer, Grade A, with effect from 13th October, 1957.

165. The following officers were on leave in the United Kingdom at the close of the year :

(v) LEAVE

Mr. P. G. Coleman, M.A. (Cantab.), A.I.C.T.A.

Mr. J. A. Cox. A.M.I.B.A.E.

Mr. J. Dore, B.Sc., (Hons.), Ph.D., A.R.C.S.

Mr. F. B. Brown, B.Sc. (Hons.), Dip. Agric. Sci. (Cantab.).

Mr. F. N. G. Conaty, B.Sc. (Hons.), A.R.I.C.

Mr. G. F. Darnell, B.Sc. (Agric.), Dip. Agric. (Cantab.), D.T.A.

(vi) DEATHS

The Director of Agriculture records with deep regret the death of Mr. J. Chattaway, Senior Lecturer, College of Agriculture, which occurred in the United Kingdom whilst on leave and also the death of Enche' Mohamed Arif bin Abdul Rahman, Assistant Lecturer, which occurred in Bungsar Hospital, Kuala Lumpur, on 23rd July, 1957.

SECTION IV

WORK OF THE DEPARTMENT OF AGRICULTURE

A.—RESEARCH AND INVESTIGATIONS

166. The recruitment of more junior staff and provision of extra funds under the Draft Development Plan has enabled some sections of the work to be intensified. This applies particularly to soil surveys, where the more generous supply of funds has tripled the rate of survey in jungle areas without any increase in senior staff. Purchase of 95 acres of padi land adjacent to the existing padi stations in Kedah, Kelantan and Malacca has made possible the planning of an increase in padi selection and breeding work. On the other hand, the continued lack of research staff in the Plant Protection Divisions has severely limited the work and though there were outbreaks of potentially serious diseases and pests, fortunately none assumed dangerous proportions. The evidence of increased results in research work is given by the number of reports submitted for publication, which has increased from four in 1955, to eight in 1956, to twelve in 1957.

1.—PADI (RICE)

(i) *Variety Selection and Breeding.*

167. The programme of selection and breeding continued during 1957 with no major modifications. The extra land available at the main Padi Experiment Stations in Malacca (17 acres), Kedah (48 acres) and Kelantan (30 acres) was used with advantage. Crops were generally very satisfactory.

168. (a) *Variety Trials.*—A number of trials have completed three or more years and some of the results which are worthy of note are given in the succeeding paragraphs:

Perlis—

Records of the trial carried out at Seriab Padi Test Station over the past four years to test the yield performances of five popular Kedah/Perlis varieties, have shown that the variety Serendah Sungei Dua 19 significantly outyielded Anak Didek 39, Serendah Sungei Dua 25 and Anak Didek 22, but not Subang Intan 16. Serendah Sungei Dua 19 is preferred, because it has done consistently better than Subang Intan 16. The yield for Serendah Sungei Dua (mean of 4 years) was 2,117 lb per acre and Subang Intan 16, 2,016 lb per acre.

Kedah—

At Kepala Batas Padi Test Station, Radin Kling, which yielded much lower than expected, was outyielded by Acheh Puteh and Tangkai Rotan. In this experiment, designed to test five varieties with a maturation period of 155 to 160 days, Acheh Puteh gave a yield of 2,802 lb per acre, (mean of 3 years) as compared with 1,982 lb per acre from Radin Kling. In a further trial, testing varieties with a maturation period of 170 to 175 days, the highest yield

was given by Subang Intan 117, but despite the considerably longer maturation period, the yield was considerably lower than for the shorter period varieties, the highest yield being 2,392 lb per acre. In two further trials at Pulau and Rantau Panjang Padi Test Stations, five popular Kedah varieties have been tested against Siam 29. Only Subang Intan outyielded Siam 29 and the yield increase was significant only at Pulau. Yields were: Subang Intan 117, 4,338 lb and 3,496 lb at Pulau and Rantau Panjang respectively; and Siam 29, 4,074 and 3,467 lb per acre (mean of 3 years).

Perak—

In trials at Bagan Serai, Selinsing and Talang, twelve selected varieties from Kedah and Malacca were tested, during four seasons, against the locally recommended variety, Seri Raja. The mean yield of padi for Seri Raja from the three stations was 1,990 lb per acre. This was not significantly more than the Nachin selections from Malacca which are, however, susceptible to lodging.

Penang and Province Wellesley—

In a trial at Bukit Merah, the short term varieties Radin Goi, Bongor and Radin Siak 34, have all significantly outyielded the other varieties, Haji Haroun, Radin Kling and Anak Ikan Rendah. Radin Goi or Radin Siak 34 are preferred to Bongor, because the latter may lodge. Varieties such as these are of importance for replacing the normal medium-term varieties in the double cropping areas.

Kelantan—

At Kota Bharu, Pasir Puteh and Pasir Mas, trials of Kelantan varieties with varieties introduced from other states have been completed. At each place the Kedah variety Subang Intan 117 was the highest yielder with gains over Anak Naga, the standard Kelantan variety of 5 per cent, 10.3 per cent and 33.1 per cent respectively.

Trials in Progress—

The first year trial at Kepala Batas, Kedah, of medium term varieties, indicates that the Sarawak varieties, Engkatek and Indai Empati have significantly outyielded the local variety Subang Intan 117 by 22.5 per cent and 15.1 per cent respectively. In Kedah and Malacca first year's trials with eight Sarawak varieties, showed that Engkatek gave the lowest yields, while Indai Empati gave the highest. However, Engkatek did not lodge while the other Sarawak varieties did; it also gives good quality rice.

The trial of semi-dry varieties from Kelantan, laid down at Parit Satu in the Tanjong Karang area with a view to selecting a suitable variety for the quick drying peat areas of Tanjong Karang, has completed two years, but only

one season's results are reliable owing to a total crop failure in the 1955/56 season. So far the results indicate that the yields of the four varieties used are poor and the differences are small and not significant.

Another trial laid down in 1952 at Tanjong Karang to find the best amongst popular varieties grown there has given valid results only in the last two years. These results indicate that Acheh Puteh and Radin Mengkudu are the highest yielders. Radin Mengkudu is expected to be preferable in this district because of its better milling and rice qualities.

169. (b) *Variety Survey*.—The five collections of Malayan varieties noted in the 1956 report have been maintained. The numbers have been reduced to 1,244.

170. The 76 varieties received through the United Nations Food and Agricultural Organization from various countries in South-East Asia were under observation during the 1955/56 season at Telok Chengai and Pulau Gadong Padi Experiment Station. Many of the varieties showed poor growth and at Telok Chengai nine varieties totally failed as a result of late flowering and consequent bird damage. At Pulau Gadong three varieties were complete failures. In addition, seven varieties were found to be red grained or mixtures of red and white grains and were discarded at both stations. On the results of observation plots maturation periods of these varieties deviated quite considerably from those given by F.A.O. In general there was a lengthening of the maturation period in those groups with a maturation period listed as less than 120 days and a shortening of the maturation period in the groups with a maturation period of 130 days or more. The results also indicate that the maturation period was usually longer in the south (Pulau Gadong) by 15/20 days than in the north (Telok Chengai). For example Group 1 with a listed maturation period of 100 days took 101 days at Telok Chengai and 124 days at Pulau Gadong to mature. On the other hand Group 6 with a listed maturation period of 200 days took 140 days at Telok Chengai and 180 days at Pulau Gadong.

171. During the past year, seven variety trials, involving 53 of these varieties, were laid down at Telok Chengai Padi Experiment Station, Kedah, and four of these were duplicated at Pulau Gadong. Growth has been better than in the 1956/57 season but is not up to the standard of local varieties and difficulties are still being encountered in synchronising flowering.

172. Ten varieties have been introduced during the year from Italy and are being grown at Kuala Lumpur to assess their suitability as breeding material.

173. (c) *Variety Selection*.—Pure line selection within 13 major wet padi varieties and one *padi tugalan* has continued. The selection programme is the same as that given in the 1956 report but the number of selections planted have been reduced from 8,080 to 4,083.

174. (d) *Trials of Pure Line Selections.*—(i) *Radin Ebos from Perlis and Kedah.*—The preliminary variety trial comparing some of the Radin Ebos selections with Mayang Ebos 80, a pre-war selection, has completed four years at Seriab Padi Test Station. The best of the Radin Ebos selections (R.E. 64) gave slightly better yield than Mayang Ebos 80 (not significant).

175. It has been decided to extend the final variety trial of 47 selections and two controls at Telok Chengai for another two years because differences have been small and there is a strong seasonal inter-action. Combined results of the first three years indicated that the better Radin Ebos selections will out-yield Mayang Ebos 80 by about six per cent.

176. (ii) *Mayang Sabatil (Penang, Province Wellesley and Perak).*—The series of identical trials of new Mayang Sabatil selections at Penang, Province Wellesley and North Krian have been concluded, but the results are disappointing. On the whole, yield increase of approximately five per cent over the pre-war selection M.S.B. 8 have been given by the new selections M.S.B. 18 and 19.

177. (iii) *Seraup (North Perak).*—The new Seraup selection, Seraup 50, continues to give excellent results in North Krian. Yield increases of 35 per cent, 24 per cent and 24 per cent over Seraup Kechil 48 at Kuala Kurau, Simpang Tiga and Titi Serong Padi Experiment Stations respectively were recorded in the second year of the trial. At Sungei Manik and Bruas Padi Test Stations, Seraup 99 has also given good results in the first year of the variety trials.

178. (iv) *Serendah Kuning (Pahang and Negri Sembilan).*—The new series of trials incorporating selections not previously tested has completed its first three years at all three Negri Sembilan stations. At Kendong, Serendah Kuning 30 has significantly outyielded Serendah Kuning 11 the present standard selection by 22 per cent.

179. The Serendah Kuning selection trial at Pahang Tua has been concluded and the results are summarised in the following table:

Yield of Padi (mean of three years)					
					lb/acre
					Per cent of Control
Serendah Kuning 29				2,507	158
Unselected Ser. Kun.				2,463	155
Ser. Kun. 11				2,355	148
„ „ 31				2,070	130
„ „ 3				1,847	116
„ „ 23				1,592	100
Seri Menjadi				1,587	100
Radin China 17				1,578	100
M.S.D. at 5% pt.				295	

The best Serendah Kuning selections have significantly out-yielded the Pahang varieties, and in any one year S.K. 29, 11

and unselected S.K. can be expected to yield more than Seri Menjadi or R.C. 17. Serendah Kuning 29 lodged less than S.K. 11 and must be preferred in this area.

180. Similar trials of Serendah Kuning selections are being continued at Dong and Kerdau. It is expected that such selections will eventually replace the local varieties in the riverine areas of Pahang.

181. (v) *Nachin*.—Results from the Nachin variety trials at Telok Chengai were not encouraging. There was very little difference in yield between the best of the Nachin selections and the local standard variety Mayang Ebos 80. In north Johore the first year trial of Nachin selections suffered heavily from bird and rat damage.

182. (vi) *Siam*.—The variety trial of new Siam selections at Telok Chengai has given good results. A number of selections have given yields up to 20 per cent greater than Siam 29 and possess stronger straw. At Jasin and Pulau Gadong Padi Experiment Station, Malacca, slight yield increases were recorded in the variety trials. These were not significant, and the degree of lodging was variable.

183. (vii) *Radin Goi*.—The trial of Radin Goi selections and mixtures of selections at Hutan Kampong Padi Test Station has been concluded after two seasons. There were no significant differences between selections and no indication that any mixture might be superior.

184. (e) *Extension Trials*.—(i) *Serendah Kuning in Negri Sembilan and Malacca*.—Extension trials of Serendah Kuning 23 were planted this year in the inland districts of Malacca. Two strains, Serendah Kuning 30 and 31, which have been successful in a variety trial at Alor Gajah are being multiplied for extension trials next season. Trials of seven Serendah Kuning strains for the areas served by Ulu Klawang, Ampang Tinggi and Kendong Padi Test Station in Negri Sembilan are also in progress.

185. (ii) *Nachin 39 in Malacca*.—Trials laid down in the coastal areas of Malacca are being continued into the second year but using fresh sites. First year extension trials have given promising results and in the 35 sites harvested, Nachin 39 outyielded Nachin 57 by 15 per cent in six plots, other selected varieties by 7 per cent in 5 plots and the unselected varieties by 20 per cent in the remaining 24 plots. This would represent an overall increase of 67.7 gantangs per acre for the three districts of Alor Gajah, Central and Jasin.

186. (iii) *Radin Ebos in Kedah*.—A new extension trial has been sited in the area south of Telok Chengai Padi Experiment Station, using R.E. 41, 64, Engkatek and the local variety.

(ii) *Hybridisation*

187. The two hybridisation projects *indica* × *japonica* and *indica* × *indica* have continued at Pulau Gadong and Telok Chengai Padi Experiment Stations. Comparative yield trials of the

oldest progenies, which have reached a high degree of homozygosity, have not been established yet through lack of staff.

188. (a) *Indica* × *Japonica* Hybrids.—There are now 2,445 ear-rows and 137 progeny plots in being and these are distributed as follows:

Indica × Japonica Hybrid Populations							
Generation	No. of Crosses	Pulau Gadong		Telok Chengai		Total	
		Ear-rows	Progeny plots	Ear-rows	Progeny plots	Ear-rows	Progeny plots
F7	4	158	4	179	4	337	8
F6	34	993	34	677	32	1,670	66
F5	16	302	14	34	10	336	24
F4	7	102	7	—	6	102	13
F3	13	—	13	—	13	—	26
Total ..	74	1,555	72	890	65	2,445	137

189. The prospects of high yielding material, responsive to fertilisers, are good. There is an improvement in yield with each succeeding generation and in the F₅ and F₆ material the yields from unfertilised progeny plots, particularly at Telok Chengai, for the 1956/57 season are now comparable to those of local varieties.

190. Yields from progeny plots of the most advanced generations averaged over 2,500 lb per acre. In some of the pedigree lines which received heavy fertiliser dressings the yields reached 150 grams per plant. The highest yielding plant in one line in the F₆ generation gave 184 grams (Serendah Kuning x Asahi).

191. At Bukit Merah Padi Experiment Station *indica* × *japonica* hybrid progeny plots have been planted in the off-season for the last two years in order to select short term strains suitable for double cropping. A few pedigree lines from outstanding plants were also established in 1957.

192. (b) *Hybrids of local varieties (indica* × *indica)*.—Progeny plots and pedigree lines of F₅, F₆ and F₇ material are established at Pulau Gadong and Telok Chengai Padi Experiment Stations. Although the homozygosity in the F₇ generation has now reached a level when normal ear to row selection and yield trials can be started, lack of staff has prevented this.

193. A new series of crosses was carried out in December, 1956/January, 1957 with the object of producing new short term, strong straw and *penyakit merah* resistant varieties, using standard selected varieties as parents. Engkatek (strong straw) Seri Raja (*penyakit merah* resistant) Radin Kling (short term non-photosensitive) Siam 29 (high yielding, good rice quality) are among the parents used. Successful crosses of F₁ material have been grown in cages at Kuala Lumpur and Pulau Gadong. All crosses exhibited hybrid vigour and some plants had up to 80 tillers, while some were over 76 inches tall.

194. The indigenous wild rice *Oryza ridleyi* has been shown to be relatively resistant to stem borers and attempts to hybridise this variety with local *indica* as well as with introduced *japonica* varieties were carried out at Kuala Lumpur. No hybrid grain has been obtained.

(iii) *Induced Mutation.*

195. (a) *X-Rays*.—Thirteen pedigree lines of X_2 progenies from Siam 29 are at present maintained at Pulau Gadong, Malacca. No elaborate tests were carried out on the X_1 progenies but the plants appeared to have stronger straw and lodged less than normal Siam 29. A trial of these mutant strains, Engkatek (a strong strawed variety) and normal Siam 29 has been laid down at Pulau Gadong Padi Experiment Station in an area where lodging usually takes place. Up to date the plants have flowered and no lodging has been reported.

196. (b) *X-Ray Backcrosses*.—Selected X-ray mutants were backcrossed to normal Siam 29 and the B_1 progenies are being grown in the padi cage at Kuala Lumpur. Grain sterility has been reduced to almost normal, but the strong strawed character of the irradiated plants is still maintained in some of the crosses.

197. (c) *Polyploidy*.—Large, long awned seed, typical of tetraploids, harvested from the colchicine-treated plants in the previous season are growing at Kuala Lumpur. It had been found that similar tetraploid grains harvested early in the year failed to give well grown seedlings, as the plumule of the germinating seedling was unable to penetrate the husk. In this case, however, healthy seedlings were obtained by removing the husk immediately after the initiation of germination, as determined by holding the grain against a bright light. The seedlings obtained by this method have grown quite well but seem to have reverted to the normal diploid type.

198. A number of seeds with characteristics intermediate between normal diploid and tetraploid were also harvested. The intermediate type germinated normally and the young seedlings were classified into two types after microscopic examination of leaf epidermal strips. The two types were seedlings having larger stomata than normal (possible tetraploids) and seedlings having small stomata (normal Siam 29). It was found that all seedlings having larger stomata produced very much larger grains with long awns typical of tetraploids. These were later found to be sterile.

(iv) *Quality Assessment.*

199. (a) *Milling*.—25 strains of Siam 29 and 42 strains of Nachin have been examined. Generally the percentage husk has a range of only two to three per cent between varieties. It is in the other components that differences between varieties are shown, especially in the percentage of broken rice and the imbibition ratio. These are shown below:

QUALITY ASSESSMENT OF PADI

Variety	Grain type		Per cent Husk	Per cent Hulled rice	Per cent Bran	Per cent Broken	Per cent Whole rice	Imbibition Ratio
Nachin	Broad Medium	Range	19.2-29.3	26.1-80.8	2.8-7.7	0.72-18.39	52.6-75.5	3.10-4.34
		Weighted mean	(20.04)	(79.96)	(5.45)	(5.99)	(68.52)	(3.81)
		Range	20.0-22.8	77.2-80.0	4.1-8.3	1.90-23.00	48.5-70.00	2.68-3.50
Siam	Long	Weighted mean	(21.55)	(78.45)	(6.57)	(8.77)	(63.11)	(3.00)

200. (b) *Iodine Indication Quality Test*.—An exploratory method of using iodine solution to test the relative quality of a number of rice varieties has been devised. The supernatant liquid from the cooking test is cooled to room temperature. A 5 mls. aliquot is mixed with 3.5 mls. of a very weak iodine solution and the blue colouration is observed after exactly two minutes. It has been found that there are differences in the intensity of the colouration produced by the varieties and that generally speaking the supernatant liquid from rice that is sticky when cooked gives a darker blue colour in this test than that from rice that is flaky. When colour standards have been established it is hoped that the tests will provide objective estimates of stickiness and possibly show a correlation with the imbibition ratio.

(v) *Nutritional Studies*.

201. (a) *Penyakit Merah*.—Field trials to investigate the physiological disease *penyakit merah* have met with little success owing to its sporadic distribution and failure to persist in the same areas in successive years.

202. In view of this, attempts have been made to induce the disease under controlled conditions with soil in pots or tanks. In the tanks, which hold 12 plants, treatments included the addition of sugar at the rate of five tons per acre, addition of chelated iron to give the equivalent of 300 p.p.m. Fe in the soil and application of a saturated solution of H_2S , injected daily near the plant roots.

203. The sugar was added to bring about the intensive reducing conditions associated with high levels of organic matter in some padi soils. Two tanks were so treated and in one, seedlings were planted with great care so that the roots were undamaged and in the other the roots were deliberately damaged. This was done because it was suspected that where conditions were adverse, damage to seedling roots would have a more depressing effect on growth.

204. The iron treatment was tried because it had been reported that work in Ceylon showed that *penyakit merah* was caused by excess iron in the soil. The treatment with H_2S was to test the reports of Japanese work on sulphide toxicity.

205. The lowest yield, 61 grams, was from the plants with damaged roots growing in the sugar treated tanks, compared to 334 grams from the control and 170 grams in the sugar treated tank with carefully planted seedlings. No conclusions can be drawn from these results, however, until the effects of root damage on the growth of plants growing under non-treated conditions are studied. The addition of iron caused stunting and reduction of yield but did not bring about symptoms of *penyakit merah*.

206. The addition of H_2S caused neither reduction of yield nor symptoms of *penyakit merah* but there was a very great increase in the growth of roots and a change in their character. The average weight of roots from the H_2S treated tank was 17

grams per plant, whereas it was only 8.5 grams per plant in the control. From these results it would appear that the older roots are killed off, but that the plant keeps on producing new roots near the soil surface.

207. In the pot experiment, reducing conditions were brought about by the use of chemicals, e.g., hydroquinone and sodium bisulphite and also by addition of chopped grass and sugar. Growth was reduced but no colour symptoms typical of *penyakit merah* were produced.

208. As none of these investigations elucidated the cause of *penyakit merah*, a series of sand culture experiments have been started to study the vital factors concerned in inducing *penyakit merah* under rigidly controlled conditions. A factorial experiment was set up in which potassium, magnesium and phosphorus were supplied to the plants at three levels (one third, control and three times the control) and chelated iron at two levels (control and five times the control). All other elements were supplied at the control level. Control levels were as follows:

Nitrogen	...	...	...	...	40	p.p.m.
Phosphorus	...	...	...	...	15.6	..
Potassium	...	...	...	...	20.0	..
Magnesium	...	...	...	...	30.0	..
Calcium	...	...	...	...	45.7	..
Iron	...	...	...	...	4.0	..

209. Potassium had the greatest effect on plant growth and the increase in the potassium levels from $K\frac{1}{3}$ to K_3 more than doubled the weight of roots and increased the weight of tops by over 70 per cent. The number of tillers also increased from an average of 9.2 to 12.8 (39 per cent increase).

210. Plants were harvested at the flowering stage and chemical analysis was carried out on the flag leaf, "remaining leaf" and stem. Nitrogen, phosphorus, potassium, calcium, magnesium, manganese and iron were determined in the different parts of the plant, with the exception of nitrogen, which was highest in the flag leaf, all the other elements were highest in the "remaining leaves".

211. The influence of the various treatments on nutrient uptake can be summarised as follows:

Nitrogen uptake was not greatly affected by the treatments though it tended to decrease with increasing K in the nutrient solution.

Phosphorus showed a sharp increase with increasing nutrient levels of P.

Potassium also increased sharply with increasing levels of K in the nutrient solution. Increase of P also caused an increase in the uptake of K.

Calcium uptake was decreased by increases in K or Mg nutrient levels.

Magnesium uptake was greatly increased when K levels were low. Increased supply of magnesium in the nutrient solution increased the amount of Mg in the leaves.

Manganese uptake decreased as the K nutrient levels increased. Plants receiving the highest level of P or Fe had reduced levels of Mn when compared to plants receiving less P or Fe.

Iron uptake was increased by approximately 50 per cent when the levels of iron in the nutrient solution was increased five-fold over the control. In the plants receiving $K\frac{1}{3}$, iron levels in the leaves increased with increased levels of P in the nutrient solution, but in plants receiving K_3 , iron levels decreased.

212. As regards production of *penyakit merah* symptoms it was found that the level of potassium in the nutrient solution appeared to control the colour of morbid leaves; high levels resulting in orange coloured leaves and low levels in medium to dark brown leaves, especially if the Mg level was high. When the K level in the nutrient solution was normal or excess, orange leaf symptoms of *penyakit merah* could be induced in a number of ways, e.g., low Mg., or P., high N or low (< 1) NO_3/NH_4 ratio.

213. (b) *Minor Elements*.—Experiments have been carried out to study symptoms of toxicity and deficiency of minor elements on padi in sand culture.

214. (i) *Toxicity*.—An experiment was carried out to study the toxicity of the minor elements, copper, zinc, manganese, boron and molybdenum. Control and excess levels were as follows:

			Control	Excess
Copper	...	...	0.02 p.p.m.	Control $\times 3$, 9 and 27
Zinc	...	...	0.05 ..	Control $\times 4$, 16 and 64
Manganese	...	...	0.50 ..	Control $\times 3$, 9 and 27
Boron	...	...	0.50 ..	Control $\times 3$, 9 and 27
Molybdenum	...	...	0.02 ..	Control $\times 100$, 500 and 2,500

215. Plants in excess manganese and boron were the only ones to show toxicity symptoms and these were obtained even at very low levels (1.5 p.p.m. in each case). The leaves with symptoms of excess manganese, showed a small amount of orange colour during the early stages, but neither these symptoms nor those of boron toxicity were the same as *penyakit merah*.

216. Plants from this experiment were harvested at the flowering stage and an analysis carried out in the same manner as for the factorial experiment. One of the most striking results shown by the analysis was the manner in which a high nutrient level of manganese led to a very high increase in the uptake of manganese by the plants. In the treatment with Mn 27 (27 times control level) the level of manganese in the "remaining leaves" reached 13,166 p.p.m., and this was 26 times the control.

217. (ii) *Deficiencies*.—Another sand culture experiment was set up to study the deficiency symptoms of minor elements in padi. Elements under study were copper, manganese, boron, zinc and molybdenum. Each of these elements was in turn omitted from the treatment.

218. Plant growth was markedly reduced in the absence of copper but leaf symptoms were not well defined. No symptoms of boron or molybdenum deficiency were obtained, and in fact plants receiving —B grew better than the controls. Manganese deficiency symptoms were very striking and similar to those of magnesium, i.e., severe interveinal chlorosis and scorching of the leaf tip. The only apparent difference between manganese and magnesium deficiency was the greener veins with a narrow green band on each side of the veins which occurs in manganese deficiency.

219. Zinc deficiency produced dark brown blotches on the younger leaves. These usually began about the middle or the lower half of the leaf and then enlarged and coalesced, eventually to cover the whole leaf. The leaf finally turned a rust colour and in some cases it tended towards a deep orange before the leaf died.

220. One of the interesting features about this series of experiments is the comparative ease with which manganese and zinc deficiency symptoms could be induced in padi, indicating the importance of these two elements in its nutrition.

221. (c) *Water Control*.—The layout for this series of experiments, using concrete tanks, is described in the 1956 Annual Report. The main-season results for 1956/57 show that straw yield and growth are affected by the off-season treatments. In this experiment the plots were split for age of seedling and it was found that planting over-aged seedlings (60 days) significantly reduced both growth (height) and yield of straw but showed no interaction with off-season treatment.

222. Growth of the second main crop suggests that differences between wet and dry off-season treatment are having a marked effect in favour of dry treatments. The yields from the first main crop under different treatments are given below:

EFFECT OF OFF-SEASON TREATMENTS ON PADI YIELD

First off-Season treatment	First main crop (Yield of padi per plant gms).	
	30-days-old seedlings	60-days-old seedlings
A—Wet Fallow	50	31
B—Dry Fallow	43	34
C—Wet—padi	44	37
D—Dry—tobacco	60	40

223. (d) *Padi on Peat*.—In a series of tank experiments in the padi cage at Kuala Lumpur, urea applied at a rate of 3 cwt per acre, six weeks after transplanting, increased the yield of grain by 46 per cent and the yield of straw by 152 per cent over the unfertilised control.

224. Variations in the depth of water also produced interesting differences in growth and yield. The shallower the water the better the growth, the best yield being obtained when the surface of the peat was kept just moist. When the water was kept at a depth of nine inches the yield was poor and the lowest yield was obtained from the tank where deep planting was carried out in deep water. The growth of the roots was also extremely poor in this treatment and the weight of dry roots for the nine plants in the tank was only 24 gms. as compared to 94 gms. from the plants in the tank where the surface peat was maintained in moist condition. Deleterious effects of both deep water and deep planting may help to explain the poor response often obtained in field trials.

225. An off-season experiment using Pebifun gave very poor growth on peat.

(vi) *Insect Pests.*

226. (a) *Stem Borers.*—In the 1956/57 season a survey to assess the prevalence of stem borers was carried out in Negri Sembilan, Selangor, Kedah, Perlis, Perak, Kelantan and Trengganu. This survey, which was carried out when the padi was in the flowering stage, showed that borer damage during the season was light in all areas. The number of tillers bored in the samples examined ranged from 1.2 per cent in Kelantan to 9.6 per cent in Selangor.

227. In the 1957/58 season a similar survey has been in progress. Up to the end of the year areas in Malacca, Kedah, Perlis, Province Wellesley and Perak had been visited. Incidence of borer is again low. The highest percentage of tillers bored (9.2 per cent) has been found in the Krian area of Perak and the lowest (1.4 per cent) in Malacca.

228. The insecticidal control experiment carried out during 1956/57 season at Padi Test Stations in Negri Sembilan, Province Wellesley, Johore, Selangor and Trengganu indicated that there is a definite loss of yield due to borer attack even in a season when incidence of the attack is low. On the other hand, in such a season insecticidal control measures, which will reduce this loss of yield, are not economic.

229. On account of this it is important to discover a method of predicting, early in the season, the probable intensity of borer attack later in the season when most damage is done by the insects and when spraying has to be carried out. Attempts to work out a method during the 1956/57 season were unsuccessful but during the current season investigations have been continued and detailed counts of borer attack have been carried out at intervals of two to three weeks throughout the season at sites in Selangor and Negri Sembilan.

230. Pot experiments at Kuala Lumpur have been inconclusive because of light and sporadic attacks by the insects.

231. Experiments to investigate the susceptibility to stem borer attack of *Oryza ridleyi* have been carried out at Kuala

Lumpur. No damage was recorded but damage to adjacent plants of *Oryza sativa* was light. Young larvae of the borer *Chilo suppressalis* (Walk.) caged on *O. ridleyi* did enter the tillers but mostly died before pupation.

232. Counts of borer damage on different varieties grown in variety trials was carried out during the 1956/57 padi season. Borer incidence was so low that no differences in borer attack between varieties could be detected.

233. (b) *Other Pests*.—The army worm *Borolia venalba* (Walk.) caused some damage in Kedah but was controlled by spraying with DDT. Other pests encountered on padi included *Parnara bada* Moore, mealy bugs (? *Pseudococcus* sp.) and *Nilaparvata* sp. The pyralid *Cnaphalocrocis medinalis* Gn. was also found causing damage in Selangor; a study of its life history has been carried out.

(vii) *Diseases*.

234. (a) *Blast*.—Tests of the comparative susceptibility of padi varieties to blast (*Piricularia oryzae*) were concluded. These tests were carried out on seedlings, the varieties used being those Malayan varieties listed in the F.A.O. World Catalogue of Genetic Stocks.

235. As a result of these tests the varieties can be classified according to their reaction to blast as follows:

Immune	...	Chantek puteh, Padang Trengganu 22, Morak Sepilai Kechil, Anak Ikan Gresing, Anak Ikan China.
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Resistant	...	Reyong 20, Aceh Puteh, Subang Intan 117, Radin Siak 34, Mayang Sa-Gumpal, Radin Che Mah, Serendah Puteh, Anak Naga, Jintan Puteh, Morak Sepilai, Anak Ikan Rendah, Radin Che Ali, Pebifun, Anak Ikan Sombong, Mayang Ebos 88, Radin Kuning, Seri Raja, Aceh.
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Slightly susceptible		Seraup Kechil 48, Radin China 17, Mayang Ebos 80.
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Susceptible	...	Reyong 6, Radin Goi, Anak Ikan Tinggi, Kontor, Serendah Sungei Dua 25, Serendah, Anak Didek.
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Very susceptible		Serendah Kuning, Chubai 18, Nachin 11, Taichu 65, Machang, Seraup Kechil 36, Mayang Sa-Batil, Milek Kuning, Siam 29.
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236. (b) *Brown Spot*.—Brown spot (*Helminthosporium oryzae*) is the commonest disease of padi in Malaya and is usually present to some extent in every padi area. Tests of varietal susceptibility are being carried out in the same way as for blast but have not so far been successful due to difficulty in working out a technique for establishing heavy infections under laboratory conditions.

2. OIL PALM

237. Investigations on oil palm are inevitably of a long term nature, but during the year steady progress has been made in establishing the co-operative breeding scheme in which four large estate groups are providing land and material. Studies on the nutritional status of the fronds of palms grown under different soil conditions have also been completed and written up for publication. Pests and diseases are becoming of increasing importance and the discovery of *Ganoderma lucidum*, hitherto a disease of old palms, on eight year old palms, is potentially serious.

(i) *Breeding and Selection.*

238. (a) *Breeding.*—On a Selangor estate thirteen acres of experiment 0.28 (K.B.iii) a short palm experiment, were planted in 1957. This includes two progenies of Dumpy dura × West African (IRHO) pisifera, two of Dumpy dura × Tumbuk Estate short dura, two Dumpy dura × semi-Dumpy dura and two semi-Dumpy dura × Tumbuk Estate short dura.

239. The short dura palms on Tumbuk Estate were grown from seed collected at Tennamaram Estate, which also supplied the seed of the parent Dumpy palm of the Serdang Dumpies. No yield records are available for the Tumbuk palms, but the field mean yield is extremely good. The palms used were selected primarily for their habit and pedigree.

240. A ten acre experiment 0.29 (K.B.iv) also of short palms, was planted on the same estate in 1957. This includes the following crosses :

- (i) Dumpy dura × West African (IRHO) pisifera
- (ii) Dumpy dura × Ulu Remis Estate short dura
- (iii) Dumpy dura × Johore Labis Estate short dura
- (iv) Dumpy dura × semi-Dumpy dura
- (v) Dumpy dura × Dumpy dura.

241. The estate short palms represented in this trial do not have the large girth and near Dumpy habit of the Tumbuk palms, but have the considerable advantage of being selected from families known to be genetically short and having individual tree yield records collected over a number of years.

242. In a third experiment on this estate, sixteen acres of tall palms in experiment 0.39 (K.B.v) were also planted in 1957. This contains the following material :

- (i) Standard estate dura planting material
- (ii) Elmina/Serdang dura selfs
- (iii) Elmina/Serdang dura crosses
- (iv) Elmina/Serdang dura × Serdang pisifera 27B
- (v) Elmina/Serdang dura × Serdang pisifera 29/36.

243. Plans for planting progeny trials on other host estates are under preparation. It has been found impossible in practice either to synchronize plantings on the four estates concerned or to

plant trials containing exactly similar progenies. Comparisons between the progenies and the different host estates will be restricted to certain broadly defined types. Distribution of seedlings from the sand beds at Serdang to host estates was limited by the poor germination experienced this year. Nevertheless the total number was almost 10,000. In order to provide 80 palms of each progeny for field trial a minimum of 120 germinated seedlings is sent to each estate.

244. During the year considerable quantities of pisifera pollen were imported from West Africa by the planting community. The Department imported pollen and seed from A.V.R.O.S. in Sumatra. This included pollen from infertile pisifera, mantled pisifera and Gunong Malaju Estate short palms. Seed of A.V.R.O.S. standard tall dura, A.V.R.O.S. tenera $\times$ pisifera and Gunong Malaju Estate short palms was also imported.

245. (b) *Selection*.—A collection of Deli dura $\times$ pisifera progenies was planted in a 1.5 acre block at the Federal Experiment Station, Serdang, in 1953. Of the 72 palms in this collection, which theoretically should have been 100 per cent tenera, only 33 palms have so far been identified as tenera and 28 as dura. Since most of the duras occur in families where West African pisifera pollen was used it seems that the pollen source rather than pollination technique was at fault. Similar material is growing on Highlands Estate where the same high proportion of dura palms has been recorded.

246. The yield of oil from experiments 0.1 and 0.2 of twenty-year old palms in field 4 at the Federal Experiment Station, Serdang, are given below :

Elmina/Serdang Deli dura Palms, Federal Experiment Station,
Serdang

Yield Records, 1957

Experiment Number	Field	Progeny	Oil Yield (tons/acre at estimated 15% extraction)
0.1	4	{ .. 45 ..	0.4
		{ .. 93 ..	0.4
		{ .. 200 ..	0.7
		{ .. 211 ..	0.7
0.2	4	{ .. 268 ..	0.8
		{ .. 97 ..	0.5
		{ .. 152 ..	0.5
		{ .. 207 ..	0.6
		{ .. 216 ..	0.7
Unreplicated	4	{ .. 206 ..	0.6
		{ .. 268 ..	0.6
		{ .. 120 ..	0.8
		{ .. 366 ..	0.8

247. The yields for experiment 0.3, containing Dumpy and semi-Dumpies planted in 1940 showed a slight decline, probably caused by over-pollination for breeding work. Yields were as follows:

Elmina Dumpy and Dumpy $\times$ Tall Dura Observation,
Federal Experiment Station, Serdang
Yield Records, 1957

Progeny							Oil Yield (tons/acre at estimated 15% extraction)
Dumpy	..	..	206	×	206	..	0.96
Semi-Dumpy	..	..	206	×	268	..	1.01
Semi-Dumpy	..	..	152	×	206	..	0.87

248. The trial of six dura progenies planted in November, 1952, at the Federal Experiment Station, Jerangau, has yielded well, and the palms are growing vigorously but inadequate pruning may be the reason for the high proportion of bunches which either aborted or had a poor set of fruit. It is interesting to note that palms in progenies A and B (below) which originated from the same estate showed severe orange spotting, while other progenies showed very little or none of this. This is further evidence that oil palm nutritional studies must take into account a considerable genetic variation and also emphasises the importance of selecting palms for growing only in certain specified environments.

249. The yields for 1956/57 for this trial are given below:

Oil Palm Progeny Trial, 0.8,
Federal Experiment Station, Jerangau,
Planted November, 1952

Progeny	Origin	Yield of Fruit	Fresh Bunches		(tons/acre)	
		1956	..	1957	..	mean
A	SOC. 6346	3.89	..	5.94	..	4.92
B	SOC. 1034	4.44	..	5.99	..	5.22
C	UR. 220/4 $\times$ 261	4.06	..	6.95	..	5.51
D	UR. 174/12 $\times$ E63/17	5.27	..	7.58	..	6.43
E	Serd. 47/2 $\times$ 25/5	4.46	..	7.03	..	5.75
F	Serd. 14/2 $\times$ 10/8	4.06	..	7.48	..	5.77
M.S.D. at 5%		0.92	..	1.05		

250. The observation block of Dumpy-backcross progenies, planted on coastal clay on an estate in Selangor, at present includes the highest yielding palms in the Department's stock of material. There is little doubt that soil rather than genetic value of the palms is largely responsible, since similar palms growing on poor inland

soil in another estate are not yielding well. The following yields were obtained from these selections:

Experiment 0.4 Dumpy-backcross Progenies,
Planted May, 1951, on Coastal Clay

Progeny				Yield of Fruit 1956		Fresh Bunches 1957		(tons/acre) Mean
<i>Semi-Dumpy</i> × <i>Dumpy</i> —								
12.3	×	1.1	..	8.9	..	9.4	..	9.2
14.2	×	1.1	..	7.7	..	10.5	..	9.1
12.3	×	1.7	..	9.9	..	10.5	..	10.2
14.2	×	1.7	..	8.7	..	10.3	..	9.5
12.3	×	3.5	..	8.6	..	9.7	..	9.2
14.2	×	3.5	..	7.6	..	10.1	..	8.9
<i>Semi-Dumpy</i> × <i>Semi-Dumpy</i> —								
14.2	×	10.8	..	8.7	..	8.7	..	8.7

251. For comparison, the table below gives the yields for similar palms planted on poor soil on an estate in Perak:

Experiment 0.6, Dumpy-backcross Progenies,
Planted November, 1951

Parentage				1957—Yield of Fresh Fruit Bunches (tons/acre)
<i>Semi-Dumpy</i>		<i>Dumpy</i>		
4.8	×	1.1	..	4.3
5.5	×	1.1	..	3.8
7.6	×	1.7	..	4.5
5.5	×	1.7	..	3.4
14.2	×	1.7	..	4.9
5.5	×	55.8	..	3.7
6.2	×	3.7	..	4.1
M.S.D. at 5% pt.				1.0

252. In another trial (Experiment 0.5.) on the same estate, Dumpy palms planted in 1951, are clearly less vigorous than adjacent estate "tall" palms or the backcross Dumpies of 0.6. Yields are under five tons of fresh fruit bunches per acre.

253. A large observation block of Dumpies, experiment 0.11, planted in January, 1953, on an estate in Johore has been brought into bearing and has given an estimated yield of only 0.4 tons of oil per acre. This compares unfavourably with adjacent estate "tall" palms of the same age which came into bearing a year earlier and now yield approximately one ton of oil per acre.

254. In a trial on Ulu Remis Estate four families of Dumpy palms are tested against one family of estate "tall" dura palms. The estate palms are taller, more vigorous and give far higher yields as is shown below:

Experiment 0.24 Dumpy and Ulu Remis dura Palms, Planted
October, 1952

Progeny				1957—Yield of Fresh Fruit Bunches (tons/acre)
Estate tall				2.8
Dumpy dura	1.9	×	3.5 ..	0.6
	3.5	×	2.4 ..	0.5
	1.9	×	2.4 ..	0.5
	2.4	×	2.4 ..	0.8

(ii) *Nutrition.*

255. A survey of the nutritive status of oil palms as indicated by the levels of the various nutrients in the fronds has been completed. Palms of different ages on estates with different soil types were studied. The results have been used to establish optimum levels of N, P, K, Ca, Mg, Fe and Mn in the fronds and these levels are being used as a basis for advisory purposes.

(iii) *Insect Pests.*

256. (a) *Bagworms.*—The bagworm, *Cremastopsyche pendula* Joannis, continued to cause considerable damage over large areas of oil palms in Perak. In laboratory tests various insecticides were compared and endrin was found to be the most effective against this pest, a 100 per cent kill of larvae being attained by spraying with a mixture containing 0.3 per cent active ingredient.

257. The main problem in the control of this pest in the field is to find an efficient method of applying the insecticide to tall mature palms. Dusting with a power duster and fogging with a TIFA machine have not proved successful. During the year an estate in Perak carried out aerial spraying and approximately a thousand acres were sprayed using endrin at about 4 ozs. per acre. Three days after spraying the highest kill of larvae found on sample trees was 48 per cent with an average of 30 per cent for all palms sampled. Results of this spraying, although not giving a very high mortality rate were considerably better than any previously obtained by other methods.

(iv) *Diseases.*

258. (a) *Basal Stem Rot.*—This disease, caused by *Ganoderma lucidum*, continues to cause considerable damage and is at present the most serious disease of oil palms in Malaya. In the past, basal stem rot has been confined almost exclusively to old palms, but recently on one estate several eight year old palms have been killed by it. This occurrence of the disease on young palms makes it a potentially much more serious disease than it was when only old palms were affected.

259. (b) *Seedling Leaf Blight.*—An experiment, the object of which is to discover whether *Curvularia* leaf blight of seedlings can be controlled by spraying with fungicides, is in progress in Johore. It is known that the disease can be controlled to some extent with copper fungicides, but as these tend to cause damage to young oil palm seedlings a search is being made for an effective non-copper containing fungicide. Materials being tested in the present experiment are thiram, captan and zineb.

260. (c) *Leaf Rot.*—A hitherto unrecorded disease has been reported from Johore. In this disease large brown rotten areas develop on the leaflets while the fronds are still enclosed in the spear. These diseased patches cannot be seen unless the spear is dissected. Later, when the leaves expand the rotten areas dry out and disintegrate giving the affected leaves a ragged appearance. A species of *Fusarium* has been isolated from the affected parts of young leaves and preliminary inoculation experiments suggest that this fungus is the cause of the disease.

3. COCONUT

(i) *Breeding and Selection.*

261. In spite of intensive efforts it has not been possible to obtain sufficient nuts from the old selected palms at the abandoned Port Swettenham Experiment Station to complete planting the progeny trials at Telok Bharu. There was a total of 194 vacant points still remaining in these trials in November for which there were no nursery seedlings coming forward. However, efforts to arrange for supplies of self-pollinated seed from selected palms growing on high yielding estates in Perak have been successful. This seed should be ready for field planting at Telok Bharu Federal Experiment Station by late 1959.

(ii) *Nutrition.*

262. The technique of frond analysis as a method of studying coconut nutrition has been tried on an estate in Perak where an NPK Mg manurial experiment is being conducted. The pinnae from the youngest fully opened frond and also from an older frond were sampled. Analysis showed that there was a very marked difference in nutrient levels in fronds of different ages, and that a sampling technique similar to that used for oil palms might be applicable to young coconut palms. The results of analysis from young palms in clear felled and underplanted areas showed that the latter had much lower nitrogen levels.

(iii) *Disease.*

263. An obscure disease has occurred in the Batu Pahat area of Johore. One of the first symptoms to appear is a premature shedding of nuts. Leaves of affected palms then wither and dry out, the oldest leaves being first involved. Later the younger leaves also wither and finally the bud disintegrates and the palm dies. No parasite has yet been found in association with the disease and its cause is unknown.

4. PINEAPPLE

(i) *Breeding and Selection.*

264. Owing to lack of staff little advance has been made on the results recorded in the 1956 Annual Report. Recording of the various selections has been continued throughout the year. Routine propagation of selected and imported material was also continued.

265. (a) *Physiology of Flowering.*—It was reported that "Planofix" (Napthalene acetic acid) was ineffective when used to promote flowering in the pineapple and it was suggested that peat water, used for making the "Planofix" solution, was to blame. In a bio-assay investigation of this problem *Psophocarpus tetragonolobus* was used as a test plant and results indicate that the activity of the hormone in peat water is less than in tap water and that this effect is not entirely due to the greater acidity of peat water. The investigation is to be continued and will be reported in full elsewhere.

(ii) *Nutrition.*

266. In a sand culture experiment with pineapple plants of the Singapore Spanish variety, started in May, 1957, symptoms of severe nitrogen deficiency were obtained. Symptoms of potassium, calcium and magnesium deficiency have also been produced, but these were not so severe, as the treatments omitting these elements were started at a rather later stage. This experiment is being repeated.

267. Analysis of pineapple leaves taken from experiment Sel. 98 showed that the leaf tip was a better indicator of potash deficiency than the base, but for accurate work it is felt that the analysis of both the base and the tip would be useful.

268. Analysis of Sarawak fruit during 1955/56 indicated that potassium manuring had no influence on quality as judged by acidity and sugar content. More recent analysis have shown that when nitrogen and phosphorus are given, addition of potassium is necessary to maintain quality. In other words manuring with nitrogen and phosphorus only, will lower the quality below that of the control.

(iii) *Canning Research.*

269. (a) *Fruit Quality.*—Samples of canned fruit from experiment J.P. 17 (potash treatment) were examined and it was found that in each case of potash treatment the acidity figures were higher and this was reflected in an improvement in flavour of the pack as compared with controls.

270. (b) *Concentrated Pineapple Juice.*—Initial experiments were curtailed because the canneries stopped production of juice owing to labour difficulties. These have now been resolved and samples have been prepared for the Lee Pineapple Company, and the United Malayan Pineapple Cannery, for their use in market surveys. The preliminary reports on samples of canned concentrate have not been promising, because on storage a darkening in colour and an off-flavour develops. Samples were stored at 10°F and at room temperature and deterioration appeared to develop equally in both. The juice used was produced by the canneries and was of variable quality; for subsequent experiments juice was produced at the Canning Research Station from fruits selected at a local cannery, thus providing a starting material of more reliable quality. A total of a hundred gallons was extracted, pasteurised and packed into gallon cans.

271. In previous experiments it was noticed that a slight darkening of the product took place during evaporation and to inhibit this, fifty p.p.m. of sulphur dioxide was added to the juice before evaporation. The resulting 60° Brix concentrate showed no change in colour on dilution to its original concentration. This concentrate was then diluted 45° Brix with original straight juice and treated as follows:

(a) Packed into cans and stored at 10°F without pasteurisation.

(b) Heated to 90°F for pasteurisation, canned, cooled and stored at 10°F.

- (c) Packed into cans which were subsequently held in water for 30 minutes at 212°F for sterilization, cooled and stored at 10°F.

272. After 24 hours storage a sample from a can of each was diluted with water to 10° Brix and examined against a control of unevaporated juice. The results were as follows:

- Sample (a) Showed no deterioration in colour or flavour.
„ (b) Showed slight browning and had an off-flavour.
„ (c) Showed pronounced browning and had a pronounced off-flavour.

This examination was repeated after two months storage and sample (a) was still perfect. There did not appear to be any further deterioration in samples (b) and (c).

273. This indicates that temperatures play an important part in the stability of this product, that preservation by heat should be avoided and that alternative methods such as cold storage, or the use of sulphur dioxide may be necessary. A further batch of concentrate has been prepared by the method outlined above and samples have been stored at various temperatures from 10°F up to 50°F to find the maximum temperature for safe keeping.

274. Samples of 45° Brix concentrate containing 300 parts p.p.m. sulphur dioxide, packed in glass and stored at 10°F and at room temperature were examined after six weeks. Both samples showed deterioration in quality due to loss in flavour and bleaching. The use of sulphur dioxide as a preservative for unpasteurised pineapple concentrate is obviously worth further investigation.

275. Unpasteurised samples stored at various refrigeration temperatures have been examined at monthly intervals and show no signs of deterioration. Samples of this concentrate have been shipped under cold storage to the Tropical Products Laboratory for examination and market appraisal.

276. (c) *Paraffin off-Flavour*.—No serious claims, on account of paraffin off-flavour, have been received since 1953, and it would appear that the Industry is losing interest in these experiments.

277. (d) *Quality of Fruit in Parent and Ratoon Crops*.—These experiments were carried out to find if any quality differences existed between the parent and various ratoon fruits. Fruit was obtained from South Malayan Pineapple Growers Company plantations and it was necessary to use fruit from different areas in order to cover up to five ratoons. Records were made of the history of each area as regards planting and fertilisation. All fruits were about 75 per cent ripe by skin colour when collected. They were analysed for total solids, pH, titratable acidity, invert and total sugars and physical characteristics such as eye depth. The results showed that there is little difference in the quality of the edible material in the parent and various ratoon crops. The depth of eye varied from 3/4 inch in larger fruit down to 3/8 inch in the smaller fruit, but did not vary with the age of the crop.

278. In a further experiment 250 fruits were examined and similar results were obtained. These fruits were harvested at 75 per cent ripeness, and the weights were recorded and are summarised below:

Weight of Pineapple Fruits from Parent and Ratoon Crops

Crop		Maximum Weight	Minimum Weight	Average
Parent	..	.. 4 lb. 15 oz.	.. 3 lb. 4 oz.	.. 4 lb. 0 oz.
1st Ratoon	..	.. 4 " 6 "	.. 3 " 1 "	.. 3 " 11 "
2nd	"	.. 4 " 2 "	.. 2 " 11 "	.. 3 " 6 "
3rd	"	.. 3 " 12 "	.. 2 " 10 "	.. 3 " 2 "
4th	"	.. 3 " 4 "	.. 1 " 14 "	.. 3 " 0 "
5th	"	.. 3 " 4 "	.. 1 " 14 "	.. 2 " 8 "

279. (e) *Can Staining*.—Canning syrup made from "Permutit" treated water was used to pack one series of cans while the control was packed with syrup made from tap-water. No difference in can staining was noted on opening after nine months storage.

(iv) *Insect Pests*.

280. (a) *Mealy-bug wilt*.—Three experiments to investigate mealy-bug wilt were carried out during the year. In the first experiment, inoculation of healthy plants with sap from diseased plants has failed to produce wilt symptoms, eight months after treatment. In the second experiment, various types of planting material from diseased plants were disinfested of mealy-bugs, planted and kept free from mealy-bugs during growth. So far no wilt symptoms have appeared on these plants. In a third experiment, which is still in progress the transmission of the wilt by the mealy-bugs is being studied.

281. Tests on the disinfestation of pineapple suckers by immersion in diazinon insecticidal solutions have given promising results. Immersion for five seconds in a solution containing 0.025 per cent diazinon followed by stacking the suckers in an upright position for 24 hours resulted in complete disinfestation of most suckers both in laboratory and field tests. Only heavily infested suckers with mealy-bugs around the base, outside the leaves, were not completely freed from infestation.

(v) *Diseases*.

282. (a) *Fruit Collapse*.—Proof that this disease is caused by *Erwinia carotovora* had previously been obtained by inoculating fruits in the laboratory. To discover whether the results thus obtained in the laboratory could be duplicated under more natural conditions, similar inoculations were carried out on fruits growing on plants in the field, using the same inoculation technique as in the laboratory. All fruits so treated developed typical symptoms of the disease within a week, whereas the check fruits, which were not inoculated but were otherwise treated similarly, remained healthy.

283. In one experiment, weekly spraying of the fruits with streptomycin resulted in a decrease in the number of fruits

affected, but the degree of control obtained was not very satisfactory. In another experiment no control of the disease was obtained by spraying with copper fungicides.

284. It would appear that, at present, control of fruit collapse must depend on field hygiene, viz., the safe disposal of infected fruit.

285. (b) *Fruitlet Brown Rot*.—Fruit in canneries in Johore and Singapore was examined during the first quarter of the year to find how much fruitlet brown rot was present. It was noted that serious fruitlet rot occurred in about five per cent of the samples of fruit examined. Slight rot, not enough to cause loss of fruit, occurred in 39 per cent of the fruit.

5.—CACAO

286. Breeding work on cacao has been largely concerned with consolidation of experiments already under way. Further experiments on microfermentation have been carried out, particularly with a view to studying the various factors affecting quality. No new major pests or diseases were reported, but a die-back, which appears to be nutritional in origin, continues to cause serious concern, and in this respect several investigations, including leaf analysis and growth of cacao in sand culture have been carried out.

287. Yields at the Federal Experiment Station, Serdang, have shown some recovery from the decline last year. Seven year old Amelonado seedlings growing in one trial were still the highest yielding material with an estimated crop of over 1,000 lb. of dry cocoa per acre.

(i) Selection.

288. (a) *Amelonado*.—This continues to yield as much or more than the Trinitario strains in trial with it in two fields at the Federal Experiment Station, Serdang. It is growing satisfactorily under thinned primary jungle shade at the Federal Experiment Station, Jerangau, under planted shade at the Federal Experiment Station, Serdang and under mature tall and dwarf coconuts at Kuala Bernam Estate.

289. The yields, however, continue to be extremely variable and the table below shows variations in such yields for Federal Experiment Station, Serdang, and Federal Experiment Station, Jerangau:

Yield of Amelonado

	Field	Acreage	Planting distance	Planted	Approximate Yield of dry Cocoa (lb./acre) 1957
F.E.S.	44A/B	2.9	12' x 12'	March, 1950	265
Serdang	46A	0.7	12' x 12'	March, 1950	501
„	47A	0.3	10' x 10'	Sept., 1950	1,022
F.E.S. Jerangau Seed Garden	A	1.64	—	1951-52	334

290. (b) *Trinitario*—(i) *Indonesian*.—In the following table results of four years yield from the progeny trial comparing five Indonesian *Trinitario* progenies and one *Amelonado* control are given; this shows that while the yields of the *Trinitario* varieties in 1957 fell to the 1955 level; the *Amelonado* continued to increase.

Indonesian <i>Trinitario</i>					
Planted September, 1950					
Yield of Dry Cocoa in lb./acre					
(assumed 40% recovery)					
Variety	1954	1955	1956	1957	
A. Getas 8	317	636	843	659	
B. Djaterongo 1	352	763	850	617	
C. Poerboyo Red	384	647	733	667	
D. Poerboyo Green	348	578	745	737	
E. Suzannasdaal	485	776	856	634	
F. <i>Amelonado</i> (from Celebes Islands)	543	853	917	1,022	
M.S.D. at 5% pt.	199	233	N.S.	N.S.	

291. Soils in the experimental area are variable and cocoa is particularly sensitive to soil variations, as is shown in the table below, which gives the yields from the lowest and the highest yielding plots of each progeny:

Highest and Lowest Yielding Plots in 1957					
(20 trees per plot)					
Yield of Dry Cocoa					
(lb./acre at 40% recovery)					
Variety	Plot yielding least		Plot yielding most		
A	275	..	1,193		
B	123	..	1,138		
C	86	..	1,156		
D	54	..	1,124		
E	7	..	1,432		
F	437	..	1,603		

292. (ii) *Malayan*.—The yields for the types planted in March, 1950 are given in the following table. Even though differences are not significant, it is worth noting that this is the first year that one of the *Trinitario* varieties has yielded more than the *Amelonado* control. The *Trinitario* crop is all the more remarkable when compared with previous years' figures.

Malayan <i>Trinitario</i>							
Yield of Dry Cocoa in lb. per acre							
(assumed 40% recovery)							
	1954		1955		1956		1957
<i>Amelonado</i>	353	..	452	..	308	..	501
Near-Criollo <i>Trinitario</i>	201	..	412	..	265	..	511
Other <i>Trinitario</i>	145	..	280	..	172	..	377
M.S.D. at 5% pt.	51	..	49	..	N.S.	..	N.S.

293. (iii) *West African*.—Mammalian pests are still causing severe damage to the crop in this field. Pod quality appears to be generally good and, except for Amelonado, less variable than other seedling material.

294. (iv) *New Guinea*.—Growth and yields remain very poor. After making enquiries from Keravat, New Guinea, it was decided that fresh importation of seedlings or clonal material is not desirable at present.

295. (v) *Samoa*.—Seedlings of "Lafi 7" planted in October, 1951, were growing in a severely eroded soil and giving very poor crops.

296. (vi) *Trinidad*.—No fresh imports of clones were made. Clones ICS 8 and 84, imported in September, 1956, were successfully established in the cutting/budwood nursery at Federal Experiment Station, Serdang.

297. (vii) *Grenada*.—Cuttings of clones G.S. 29 and G.S. 36, imported in September, 1956, were successfully established in the Serdang nursery.

298. (c) *Upper Amazon*—(i) *Progenies*.—A small plot of 39 seedlings was planted at Serdang in October, 1952. The seed was obtained from W.A.C.R.I. and the seedlings are thus two generations removed from Pounds original (Po) Upper Amazon clones (e.g., Nanay 33).

299. In 1957 the crop from this plot showed a fall in yield compared with 1956, and although soil fertility or planting distances (12'×12') may be at fault, this failure to bear out the promise of early yields is disappointing. However, the accumulated yield to date still compares favourably with the Amelonado. Comparative yield tables are as follows:

Upper Amazon (F₂) Seedlings

W.A.C.R.I. Pedigree			No. of trees at Serdang	Estimated Yield (lb./acre at 40% recovery)		
				1955	1956	1957
T12—62	..	..	10	349	593	681
T12—114	..	..	3	416	753	718
T56—59	..	..	6	102	155	98
T60—962	..	..	2	278	345	199
T63—966	..	..	7	167	428	341
T86—955	..	..	11	395	728	535
Weighted mean	..	..	—	285	501	429

Upper Amazon and Amelonado

Accumulated Yield in lb. of Dry Cocoa per acre
(assumed 40% recovery)

		Months from planting						
		18	24	30	36	42	48	60
Upper Amazon	..	2	82	318	383	662	878	1,351
Amelonado (mean from 3 fields)	..	1	2	2	22	109	291	735

300. Controlled and open pollinated seed from selected Amazon trees in this block were used to plant some 20 acres on an estate in Trengganu this year. At least half of these seedlings are to be budgrafted with selected Upper Amazon or Trinitario clones.

301. An attempt to establish on this estate an isolated seed garden of selected Upper Amazon seedling stocks was largely unsuccessful through poor growth of the stocks.

302. (d) *Selection Trials*—(i) *ICS Clones*.—In experiment C. 42 at Federal Experiment Station, Jerangau, eight clones are tested as buddings and cuttings against the control of Amelonado seedlings. Some difficulty has been experienced in establishing the cuttings and obtaining seedling root stocks suitable for budgrafting. Upper Amazon and Amelonado seedling root stocks are compared in this trial, and there are indications that ICS clones are generally more successfully budgrafted on to Amelonado stocks than Upper Amazon stocks. However, seedlings grown from three of the selected Serdang Upper Amazon trees seem to make better stocks than the others.

303. (ii) *Other Trinitario*.—With the establishment of a small third trial, the preliminary clonal selection block was completely planted up during the year. Each clone is represented as buddings in two plots of six plants each and this gives a total of 193 clones under trial.

304. At the Federal Experiment Station, Serdang, Field 45A is being progressively planted with any selected clones which are considered to be of particular value. The white flowered Criollo, which has no obvious economic importance at present, is included. Each clone is represented by one plot of five cuttings, and scattered among these plots are a few plots of Amelonado "clones". The first group of cuttings was planted in September, 1955, and the total number of clones planted up to the end of the year was 85 Trinitario and 5 Amelonado.

305. For the purpose of breeding it has been assumed that the Amelonado seedlings are almost completely homozygous and the plots of Amelonado clones will therefore check on this assumption in addition to serving as standard controls for the planting.

306. (iii) *Upper Amazon*.—The early yields of the F₂ Upper Amazon seedlings at Serdang were so good that it was decided that no time should be lost in putting down a clonal trial (C. 40) of the most promising trees at the Federal Experiment Station, Jerangau. Thirteen trees out of the thirty nine in the plot were selected for this clonal trial, so that all potentially valuable material should be included.

307. There is little doubt that if clones, instead of seedlings, are to be grown in Malaya, buddings will be more easily produced than rooted cuttings. For this reason the Upper Amazon clonal trial follows the same pattern as the ICS clonal trial in comparing buddings with cuttings and root stocks grown from

Amelonado seed with root stocks of Upper Amazon seed. Though difficulties in establishing the trial have been considerable, the material planted in each replication is of uniform age so far as is possible.

308. The trial is planted in isolation from the other cacao at Jerangau so that it could eventually be used as a seed garden, if this proved desirable.

309. Another trial at the Federal Experiment Station, Jerangau, (C. 50) provides for a comparison of two of the clones represented in the above trial with Amelonado seedlings. It has also been possible to include in this trial three of the eight Po clones recently imported from Trinidad. The clones are all budgrafted on the Amelonado seedling stocks.

(ii) *Breeding.*

310. (a) *Hybrids*—(i) *Amelonado* $\times$ *Nanay 32*.—The hybrid seedlings are clearly more vigorous than the interplanted Amelonado. This is confirmed by the crop, as there are as yet no pods from the 25 Amelonado trees and 33 pods from the 75 hybrid trees. These results thus bear out the measurements which showed that the hybrids had significantly greater girths.

311. (ii) *Amelonado* $\times$ *Malayan Trinitario*.—Yield records from this trial are of no value because of the poor growth. It is of interest to note that pods harvested from hybrid trees appear to be intermediate between the parental types, but in contents resemble the Amelonado parent more closely. All hybrid trees tested for compatibility have proved self-incompatible like their Trinitario parent.

312. (b) *Progeny Selection*—(i) *Main Blocks*.—The programme for planting up this progeny selection block was given in detail in the 1956 Annual Report; the sixth and final trial was planted during the year.

313. (ii) *Inbreds and Criollo Types*.—In these trials, also described in detail in the 1956 Report, establishment was completed.

314. (iii) *Upper Amazon Backcross*.—This small trial at Federal Experiment Station, Jerangau, of six ($F_2 \times Po$) Upper Amazon seedlings, is designed to give early information on the potential value of the Po clones when used for breeding. It includes, as an observation only, seedlings planted 8 feet apart on the square and seedlings planted 12 feet apart.

315. (iv) *Seed Gardens*.—The nursery at Federal Experiment Station, Jerangau, which is to contain a nucleus of all clones considered to be of potential breeding value has been planted with the Amelonado root stocks; bud-grafting will commence early in 1958.

(iii) *Nutrition.*

316. (a) *Deficiency Symptoms of the Major Elements*.—A small observation sand culture trial was carried out in order to establish, for Amelonado cacao, typical deficiency symptoms of

the major elements. The trial was not entirely successful since the level of nutrients chosen for the control was based on Trinidad data and under the conditions of the experiment, 50 per cent shade, this level appears to have been too high. However, symptoms of magnesium, potassium and phosphorus deficiencies were obtained and low levels of nitrogen and calcium severely reduced plant growth without giving any clear leaf deficiency symptoms.

317. (b) *Chloride Toxicity*.—Experiments were also carried out on sodium chloride toxicity in sand culture. Three levels of chloride ion were tested, viz., 400, 800 and 1,200 p.p.m. Reduced plant growth and chloride toxicity symptoms were only obtained in the 1,200 p.p.m. level.

318. (c) *Die-back*.—The incidence of a die-back preceded by a marked leaf chlorosis at both Federal Experiment Station, Jerangau and Federal Experiment Station, Serdang, has caused considerable worry. No pathogens causing this type of die-back have been discovered and it has been assumed that it is probably nutritional. Analysis of a set of samples of healthy and chlorotic leaves from Serdang showed that in the chlorotic leaves calcium was considerably lower, and potassium higher than in healthy leaves. Manganese was also lower in the chlorotic leaves.

319. Further analysis of leaves from healthy trees and those showing die-back at the Federal Experiment Station, Jerangau confirmed that the good trees had a higher calcium and lower potassium content than the poor trees. Manganese in the good trees was also higher. From results of leaf analysis carried out to date it would appear that the elements involved in the die-back of cacao are calcium, manganese and possibly iron.

(iv) *Processing*.

320. (a) *Microfermentation*.—An experiment was carried out to find a suitable fermentation time for white beans because it is said that they require a shorter fermentation time than purple. It was assumed that their fermentation, if allowed to continue the full time, would follow the same temperature pattern as any other cacao.

321. A microfermentation was run through a standard time of four days at 35°C and three days at 50°C with daily stirring of the cocoa. Five podfuls of white beans, all from the same tree, were fermented for times of 2, 3, 4, 5, and 6 days. These were made into chocolate and sent to Cadburys for examination and they reported that the 5-day fermentation appeared best.

322. Some work has also been done on permanganate number determinations. This is the number of mls. of 0.1N potassium permanganate required to oxidize the aqueous extract of one gm. of dried cocoa nib, and is said to bear some relation to the bitterness and state of fermentation of the cocoa beans. The number was found to be highest in fermented beans, but so far no results of practical application have been obtained.

323. (b) *Drying Experiments*.—Five lots of wet fermented cocoa from Serdang were dried in a fan blown oven at temperatures

ranging from 28 to 60°C. Samples of each lot, sun dried at the laboratory and at Serdang, were used as controls. Results show that drying at the higher temperatures gives a higher percentage of plump beans and reduces the number of purple beans. Samples of chocolate made from beans dried at these high temperatures had a slightly acid taste, but it is possible that such acidity may disappear during commercial processing.

324. The artificially dried beans have an uneven appearance unless they are frequently turned during the early stages of drying since the fragments of pulp are not evenly spread over the surface. Drum drying should improve the product. In this respect a rotary drier has been made by the Agricultural Engineer at Serdang for carrying out such experiments.

325. (c) *Chocolate preparation*.—Some work has been done on the addition of various chemicals to chocolate in order to guide tasters in the detection of bitterness, astringency, acetic and butyric tastes. Chemicals used were:

Cinchonine Sulphate	(bitter)	0. 4%
Tannic acid	(astringent)	0. 4%
Acetic acid	(acetic)	0.07%
Iso-butyric acid	(butyric)	0.03%

326. Cinchonine sulphate left a distinctly unpleasant bitter after-taste, butyric acid was easily detected by smell but not by taste. Most tasters noticed the tannic acid and the acetic acid was also noticed and it appeared to give a peculiar sweet taste which was not pleasant.

327. A report was received from Cadbury Brothers giving their views on the taste of chocolate which they prepared from samples of Upper Amazon, Amelonado and ICS. cocoa. They noted an off-flavour in chocolate and said this was due to the beans and not to processing.

328. They have also reported that acidity in cocoa beans is a lesser fault than internal mould. Thus, even if artificial drying results in slight acidity, it is better to use dryers than to risk mould by attempting to sun-dry cocoa during bad weather.

329. (d) *Commercial Dried Cocoa*.—Reports have been prepared on an inspection of 32 batches of commercially fermented cocoa. It would appear that cocoa with under ten per cent of purple beans is more likely to have mould. Cocoa with an acetic aroma is unlikely to have much mould and tends to have more purple beans. Two samples from Perak were exceptional in that they had a fairly high proportion of purple beans and yet were mouldy, one having 10 per cent mouldy beans and the other 60 per cent; this may be due to bad storage.

330. For the purposes of classification “purple” includes all beans from under-fermented cocoa, and includes all slaty to brown beans containing a trace of purple colour. “Mouldy” refers to internal mould. The present system of downgrading cocoa in direct proportion to the percentage of purple beans together with the manufacturers’ objection to acidity, encourages the over-fermentation which is associated with mould development. Cocoa

with a high percentage of purple beans has given good chocolate though with acetic odours, but these can be removed in processing, while mould cannot.

331. A sample of cured cocoa from Jerangau had unusual white spots on the cotyledons which did not look like mould. Samples of cut beans were sent to Cadburys who gave as their opinion that these spots contained the bromine and were not cocoa butter or mould. The reason for these white spots is not known, but it has been suggested that their development may be associated with the weather conditions in the field. These white spots are worth nothing because, in marketing, they could be mistaken for mould and thus lower the value of the cocoa.

(v) *Insect Pests.*

332. (a) *Helopeltis*.—Three experiments, to discover the most economic and efficient method of controlling this serious pest of cacao, were laid down during the year. The first was carried out in Trengganu, the object being to compare fogging with BHC., DDT., and dieldrin and dusting with BHC. This experiment was terminated after three months, because of the continued low incidence of *Helopeltis*. One other trial to compare fogging and mist blowing, using DDT. and BHC., designed to be laid down at the Federal Experiment Station, Serdang, has been delayed because the *Helopeltis* population is low, due to intensive counter measures in the past. Another trial to compare the effectiveness of aldrin, dieldrin and BHC. applied by mist blower has been designed for Kampong Awah, Pahang, and is similarly awaiting a population build-up.

333. In connection with these trials and control of other pests on tree crops, a test has been completed to compare the amount of residual deposit on cacao foliage given by dry fogging, wet fogging and mist blowing. A method of employing a fluorescent tracer was used. Results indicate that either type of fogging gives little deposit on the foliage, and that only on trees close to the line of fogging. The amount of deposit given by these methods of application and its distribution over the leaves would not, it is considered, give an effective coverage of insecticide. Mist blowing is a more efficient method of distributing the same amount of material evenly over the foliage to give a residual deposit.

334. (b) *Other Pests*.—Caterpillars of two species of moths, *Hyposidra talaca* (Walk.) and *Porthesia scintillans* (Walk.) were found feeding on young cacao leaves at the Federal Experiment Station, Serdang. *Indigofera teysmanni* planted as shade in the cacao area was also attacked. Control was affected by spraying with dieldrin. A species of bagworm, so far unidentified, was also found in the same area feeding on cacao shoots.

335. Slight damage was caused by the bug *Lawana conspersa* (Walk.) on an estate in Perak, but the insect was controlled by dusting with BHC. Other pests recorded during the year included the tussock moth *Dasychira osseata* (Walk.) and the stem borer *Zeuzera conferta* (Walk.).

(vi) *Diseases.*

336. (a) *Disease Survey.*—A disease survey, started in 1956, was continued in Malacca and Pahang. Diseases observed included die-back, associated with *Thyronectria pseudotrichia*, and thread-blight. The marginal necrosis and die-back, which is particularly severe in Trengganu and which appears to be due to some unfavourable soil condition, was also observed in a mild form in both States (See para 318).

337. (b) *Die-back.*—In the preliminary investigations carried out at the Federal Experiment Station, Serdang, *Botryodiplodia theobromae* was the fungus almost exclusively isolated from branches affected by die-back, but it was later found that *Calonectria rigidiuscula* was usually obtained when isolations were made from the extreme edge of the infected branch. It thus appears that *Calonectria* is the primary parasite, but that tissues killed by it are soon invaded by *Botryodiplodia*. The symptoms are distinct from those of the nutritional disorder described in para 318.

6.—TEA

(i) *Selection.*

338. No selection work is being undertaken at present by the Research Branch, but clonal selection of lowland tea is proceeding under the direction of the Agronomy branch.

(ii) *Insect Pests.*

339. (a) *Helopeltis.*—This pest can be controlled by spraying or dusting with DDT but it is thought that more economical control can be achieved by fogging, using a portable fog generator. An observation trial to discover whether fogging is effective against these pests has been laid down at the Federal Experiment Station, Cameron Highlands and pre-treatment assessments of damage are being carried out on samples of plucked tea.

(iii) *Diseases.*

340. (a) *Blister Blight.*—An experiment, the object of which is to find the least expensive method of controlling blister blight (*Exobasidium vexans*) with a fungicide is in progress on an estate at Cameron Highlands. Three copper fungicides are being used, applied respectively by spraying, dusting and fogging.

341. In the experiment being carried out at the Federal Experiment Station, Cameron Highlands, to discover the effect of blister blight on yield, results of the first 26 months' plucking indicate that the disease has not caused any loss in yield.

7.—FOOD CROPS

(A) *Soya Bean*

342. Selection trials of three years duration were in the second year during 1957. Viability of soya bean seed is still the primary factor limiting yields for this crop. In this connection germination of seeds was improved by treating the seed with a

fungicidal dressing. Materials tested contained as their active ingredient an organic mercurial compound, thiram and captan. Of these, captan gave the best results.

(B) Groundnut

343. The three year selection trials were in their second year in 1957. Weather conditions have been responsible for one heavy and one light crop.

(C) Tomato

344. Means of controlling bacterial wilt, a serious disease of tomato, which is caused by the same organism (*Pseudomonas solanacearum*) that attacks tobacco, are being sought and several methods have been under investigation.

345. No success has been obtained in an experiment interplanting maize and tomato. Spraying tomato plants with an antibiotic (*Agrimycin-100*) has also been tried, but sprayed plants were as badly affected as untreated plants. Another field trial is in progress to discover whether flooding the soil for a period before planting will reduce the incidence of the disease.

346. A different method of preventing this disease would be to graft tomatoes on to resistant root stocks. Following a report from British Guiana that this method is being used successfully there, the technique is being tried out here using brinjal (*Solanum melongena*) as the stock. The first grafted plants have successfully reached the fruiting stage.

(D) Cabbage

347. Results of an experiment carried out at Cameron Highlands on the control of the diamond back moth (*Plutella maculipennis* Curt.) on cabbages by spraying with insecticides confirmed that DDT and BHC are no longer effective against this pest. Almost complete control of the caterpillar was obtained with a 0.04 per cent spray of diazinon, applied at weekly intervals from transplanting until two weeks before harvest. The increase in yield from this treatment was calculated at 15 tons per acre. There was no residue of diazinon at harvest. Spraying with dieldrin (0.15 per cent active ingredient) also gave good control but this insecticide is not recommended for this crop as its persistence results in a considerable residue at harvest.

348. The flea beetle, (*Phyllotreta sinuata* Redt.) causes severe damage to young cruciferous seedlings. Laboratory tests, using insects caged on seedlings grown in pots, indicate that control can be obtained by the frequent application of sprays containing 0.1 per cent diazinon or malathion.

(E) Miscellaneous Crops

349. *Erias fabia* Stoll.—The life history and habits of this Noctuid borer which attacks ladies fingers (*Hibiscus esculentus*) are being investigated.

8.—TOBACCO

350. (a) *Bacterial Wilt*.—This disease, caused by *Pseudomonas solanacearum*, often causes heavy losses in tobacco planting, and has recently been very severe in the Lenggong area of Perak. Experiments have been carried out at the Federal Experiment Station, Kuala Lumpur, to investigate the possibility of controlling the disease by partial sterilisation of the soil with DD soil fumigant. The first experiment gave inconclusive results due to low incidence of the disease in the experimental area. In the second experiment soil fumigation reduced the numbers of plants affected by the disease, but did not eliminate it. Of the plants not killed by bacterial wilt, those growing in treated soil showed much improved growth compared with those in untreated soil, a side effect often observed with DD soil fumigant.

351. (b) *Black Shank*.—A disease, in which the base of the stem becomes black and rotten, causing wilting and death of the plant, has been observed for the first time. The symptoms resemble those of black shank which occurs in other tobacco-growing countries, and is caused by *Phytophthora parasitica*. A species of *Phytophthora* has been isolated from diseased plants, but has not yet been identified. Only a few affected plants in one locality have so far been found.

9.—SPICES AND DRUGS

(A) Cloves

352. *Sudden death and die-back*.—Measures for the control of sudden death (*Valsa eugeniae*) and die-back (*Cryptosporella eugeniae*) have been recommended. To test these recommendations observation plots were laid down in Penang in 1956. So far neither disease has caused much damage in the test areas, either in the plots in which recommended control measures (mainly field hygiene and careful cutting out of diseased trees or parts of trees) are being adopted or in the plots in which no control measures are being used.

(B) Derris

353. *Analysis*.—A quicker method of analysis for determination of the rotenone content has been tried out. Fairly good agreement has been obtained with the standard method in samples containing more than three per cent rotenone. If samples are low in rotenone the method is not successful. However, derris with less than three per cent rotenone is of little interest economically.

10.—FRUIT

(A) Citrus

(i) Processing.

354. Batches of mandarin oranges at various stages of ripeness were used in canning trials. Owing to the presence of seeds in over 90 per cent of the segments, the canned product is of a very low standard and inferior to that from Japan. These trials are to be repeated.

(ii) *Pests.*

355. Treating citrus foliage and fruit at intervals of three weeks with a spray containing 0.3 per cent dieldrin failed to reduce attack by fruit borers and fruit flies. This test was carried out on an estate in Selangor where *Citripestis sagittiferella* Moore was the most prevalent species of borer although *Prays endocarpa* Meyr. was also present.

(B) *Papaya*

(i) *Varieties.*

356. Seed of two Australian varieties (Hortus Gold and Warner Solo) was imported and propagation of this material is at present managed by the Agronomy Branch.

(ii) *Preservation.*

357. A comprehensive report was received from the Tropical Products Laboratory on the samples of canned papaya in syrup sent to them for market appraisal. From this it may be concluded that there is little prospect of finding a market for this product in the United Kingdom. This is due mainly to the fact that this fruit is comparatively unknown and its flavour is unacceptable and cannot compete against other well established fruits such as peaches, pineapples and apricots, which are now freely available. Two of the cans sent to London were returned for testing and on opening showed that the fruit which was packed "firm ripe" had disintegrated considerably, probably due to shaking during transit.

(C) *Rambutan*

(i) *Processing.*

358. Canning trials were carried out on 1,300 fruit from 13 different clones. The fruits were canned in syrup and are to be opened after six to nine months for quality assessment.

(ii) *Pests.*

359. Caterpillars of two Noctuid moths, *Serrodus campana* Gn., and *Oxyodes scrobiculata* F. caused serious damage to rambutans in Johore by feeding on the flowers and young shoots. The attack was checked by fogging with DDT.

(D) *Durian*

(i) *Pests.*

360. The larvae of the Pyralid moth *Dichocrocis punctiferalis* Gn., not previously found on this host, bored fruits of durian in Selangor.

(ii) *Processing.*

361. A complete analysis was done on a sample of durian pulp.

11.—CANNING COURSES FOR WOMEN'S INSTITUTE

362. Six courses, each of ten days duration, were conducted for members of this Institute. Each course was attended by six women and they were taught:

- (i) Principles of food sterilization by heat.
- (ii) Preservation of food stuffs in glass jars and cans.
- (iii) Use of a pressure cooker.
- (iv) Operation of a domestic can closing machine.
- (v) Preparation of jams and jellies.

363. The students were shown how to can a wide variety of local fruits in syrup and how to preserve a number of local vegetables. They were also taught the method of making jams and jellies from such fruits as mangosteen, guavas and papaya. A method of canning chicken in curry also evinced considerable interest. The students were supplied with notes in Malay on the subject matter of the course and leaflets in Malay, Chinese and English are in course of preparation.

12.—PASTURE, FODDER AND FEEDS

364. Six samples of guinea grass from the Federal Experiment Station, Serdang, were analysed and reported on in connection with selection work on foreign varieties of grasses. Three of the samples were below average in protein while the other three were above average.

365. Samples of dolphin bone and dolphin meat meals were analysed for the Fisheries Department. The meat meal was found to be extremely high in protein as it contained almost 80 per cent.

13.—MISCELLANEOUS PESTS AND DISEASES

(i) *Plant Pests.*

366. (a) *Kapok*.—Kapok trees at the Federal Experiment Station, Serdang, were found to be affected by canker resulting in the death of attacked branches. A species of *Colletotrichum*, isolated from diseased tissues was found to be the cause of the disease. Only young trees appeared to be susceptible to this disease and control was achieved by cutting out and destroying affected parts.

367. (b) *Coffee*.—An extensive outbreak of the clear-winged hawk moth *Cephanodes hylas* L. occurred on an estate in Selangor. Several methods of control were tried, but the cheapest was found to be hand-picking of the larvae. Other pests causing damage on this crop during the year were the gelatine grub *Chalcoscelis albiguttata* Sn., the cockchafer *Apogonia* sp. and the berry borer *Cryphalus hampei*. Ferr.

(ii) *Soil Borne Pests.*

368. In a test of the residual effect of different concentrations of dieldrin in dry soil the treated soil continues to be toxic to termites three years after application of the insecticide.

369. Tests of the resistance to termite attack of P.V.C. and polythene-insulated telephone cables and polythene sheets have been continued. Recent results show no increase in attacks on telephone cables but there has been a slight increase in attack on polythene sheets.

(iii) *Stored Products.*

370. Several samples of rice have been examined during the year for insect pests and advice given on the use of insecticides to control them. Infestation by the rice moth *Corcyra cephalonica* Staint. and the fig moth *Ephestia cautella* Hamps. has caused concern and the life-histories of these two insects have been investigated. The Khapra beetle, *Trogoderma granarium* Ev., was found in two samples of Burma rice. There have been very few previous records of this pest in Malaya.

371. A sample of maize, received for examination, was found to be infested with a species of the saw-toothed grain weevil (*Oryzaephilus* sp.). Recommendations for disinfestation were given.

(iv) *Quarantine.*

372. During the year 186 consignments of planting material for export and import were examined. Fumigation and other treatments have been carried out where necessary. Seventy herbarium specimens and cultures were sent to the Commonwealth Mycological Institute for identification and 45 specimens were identified by that institute.

(v) *New Records.*

373. The following insect pests and diseases were recorded during the year:

	Host		Damage	Organism
Cacao		Leaves	.. ..	<i>Striglina</i> sp.
"		"		<i>Thrips?</i> <i>minor</i> Bagnall
Oil Palm		"		<i>Hoploedipus</i> sp.
"		"		<i>Parastasia confluens</i> Westw.
"		Dying fronds	.. ..	<i>Dinotrrips</i> sp.
"		"		<i>Leptolothrips</i> sp.
<i>Rosa</i> sp.		Stem	.. ..	<i>Hemiberlesia lataniae</i> (Sign)
<i>Zea mays</i>		Leaves	.. ..	<i>Rhopalosiphum padi</i> (L.)
<i>Pandanus tectorius</i>		Boring in stem	.. ..	<i>Acara morosella</i> Walk.
<i>Capsicum grossum</i>		Ripe fruit rot	.. ..	<i>Gloeosporium</i> sp.
<i>Mangifera foetida</i>		Leaf spotting and die-back	.. ..	<i>Colletotrichum</i> sp.
Sweet potato		Witches' broom	.. ..	Suspected to be a virus
<i>Desmodium ovalifolium</i>		Mosaic	.. ..	" " " "
<i>Clitorea</i> sp.		"		" " " "
Soya bean		"		" " " "

14.—CROP SAMPLING AND ANALYSIS

374. Samples of oil palm fruit, palm oil sludge tank water, pericarp residue and the "dust" separated from it, cabbage leaves for insecticidal residues, water for arsenic and garlic for preservative, were among samples analysed.

375. Moisture content was determined in 188 samples of padi and rice, some of which were submitted by the Ministry of Commerce and Industry.

376. A total of 158 samples of various materials were analysed for the public. This included palm oil (101) coconut oil (27) oil palm pericarp residue (17) rolled oats (2).

377. Advice was given on the following: change in specific gravity with temperature in palm oil, deterioration of palm oil on storage, setting up an estate laboratory, local production of palm kernel cake, checking of thermometers for Ministry of Commerce and Industry, preparation of "Bee Hoon" from broken rice.

15.—SOIL INVESTIGATIONS

378. A start was made on sorting out the mass of data on profile descriptions and results of laboratory analyses, which had accumulated during the course of several years of systematic soil survey, with the object of producing eventually a reference manual of Malayan soils.

379. With increased availability of staff, equipment and funds the tempo of soil survey was increased and during 1957 about 300,000 acres were soil surveyed.

380. Requests for detailed surveys in connection with Land Development Authority projects continued to increase and the maps produced by these surveys, are providing a sound basis on which to plan development schemes.

(i) *Soil Sampling and Analysis.*

381. During the year 4,254 soil samples were received and on these a total of 37,157 analysis were carried out. In connection with nutrition work 1,622 plant samples were collected and on these 7,056 analyses were carried out.

382. (a) *Methods of Analysis.*—(i) *Phosphorus.*—Work continued on the estimation of the various phosphorus fractions in soil. Digestion of the soil with perchloric acid was found to be a useful method in the determination of total phosphorus.

383. (ii) *Cation Exchange Capacity.*—Experimental work continued on developing the barium chloride method of determining exchangeable cations and cation exchange capacity, so that it can be used on a semi-routine basis. Several problems have arisen, e.g., it was found that at one stage of the analysis, calcium was co-precipitated with the excess of barium ion leading to low results for exchangeable calcium. This error was eliminated by the addition of hydrochloric acid to the solution prior to precipitation. Results for cation exchange capacity and content of exchangeable cations as determined by the barium chloride method and the widely-used, though somewhat slow, ammonium acetate method, are in good agreement. The present study of the exchangeable base status of Malayan soils is yielding information of considerable interest. It would appear from the results that even the best of the upland soils of Malaya are low in exchangeable bases, particularly calcium, when compared with corresponding soils in Africa.

384. (iii) *Nitrogen*.—Two methods for the determination of nitrate in padi soils were examined, viz.: the sulphonic acid method and the 2:4 xylenol method. It appears that when dealing with soils containing appreciable quantities of organic matter, a preliminary separation by diffusion is necessary when the sulphonic acid method is applied. This requires special apparatus and is time consuming. The 2:4 xylenol method on the other hand apparently does not require any special treatment to be applied to organic soils. Consequently the latter method was used in a preliminary examination of the nitrate status of some padi soils from Sungei Burong and Sekinchang, in Selangor. Though sampling errors are large, the results indicate that nitrates accumulate near the surface is bare ground and are readily leached by rain. The amount accumulated is not large and the maximum found was only 26 p.p.m. (as nitrogen). This was obtained after a fairly long spell of dry weather. In areas where the ground was covered with weeds or other plants there was little or no nitrate accumulation.

(ii) *Soil Surveys*.

385. (a) *Dryland Soil Surveys*.—(i) *Kelantan*.—The major part of the season was taken up with a detailed reconnaissance survey of some of the more promising undeveloped areas of Kelantan. In the seven months' field season, some 200,000 acres of jungle country were examined on a detailed reconnaissance basis, which involved *rentis* examination at about 2/3 mile intervals throughout each area. These surveys indicate that the acreage of dryland soils, suitable for development, is rather less than is generally assumed by those unfamiliar with the interior of the country. This is largely due to steep slopes, even at elevations of less than 250 feet, which render such land unsuitable for agricultural development. The soils show considerable differences from place to place, this being a reflection of the nature of the underlying rocks from which they are derived, but in general the Kelantan soils are rather better than those found in other parts of the country. This is particularly the case in the Sungei Pergau valley, and along the road between Batang Merbau and Jeli, and also in the Sungei Pahi area to the south-east of Kuala Krai. On the other hand the northern part of the Bukit Kemahang Forest Reserve contains soils of much below average fertility. Preliminary field work in the upper Sungei Lebir and Sungei Aring valleys indicates that several promising areas for future agricultural development exist in this region.

386. (ii) *Trengganu*.—Following the detailed reconnaissance surveys of areas believed to be suitable for cacao in the undeveloped parts of Trengganu, a schematic soil map of the State on a scale of 1:500,000 was drawn up for publication in the final report. This map was prepared from pre-existing data obtained from topographical and geological sources, combined with knowledge of the distribution of the various soils accumulated during the soil survey field work. Similar maps will be drawn for each State where any large scale reconnaissance field work is being undertaken, and a soil map for Kelantan is now being prepared on the same scale.

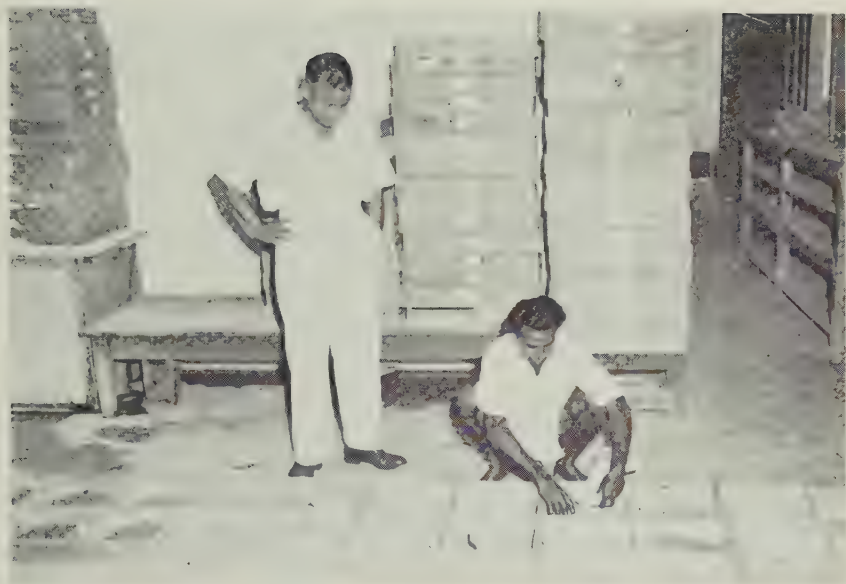
387. (iii) *Kedah*.—Reconnaissances of three areas, totalling over 14,000 acres, were made in Kedah, where reports on the nature



Members of a soil survey team in camp during a soil reconnaissance expedition, several of which were carried out in Ulu Kelantan during the year



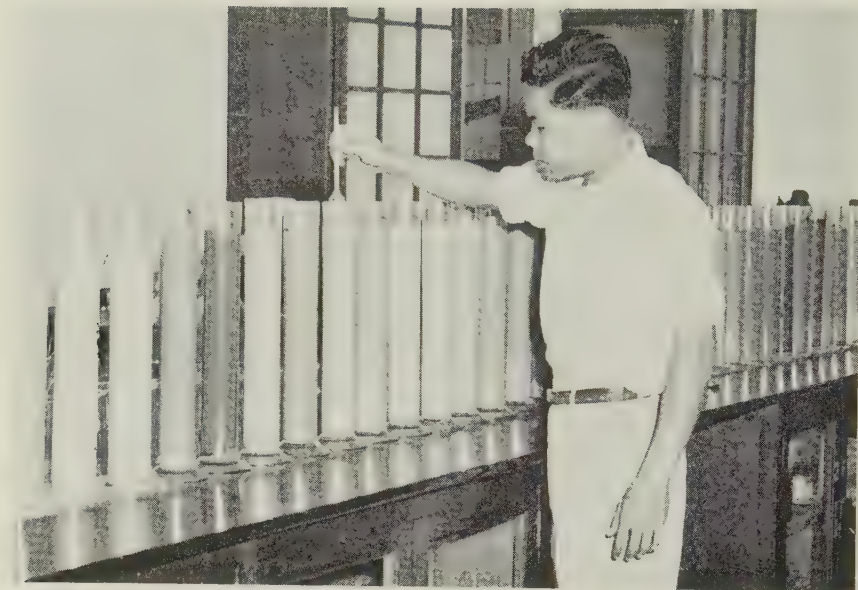
An Agricultural Assistant taking soil samples for laboratory examination in an area scheduled for agricultural development by smallholders



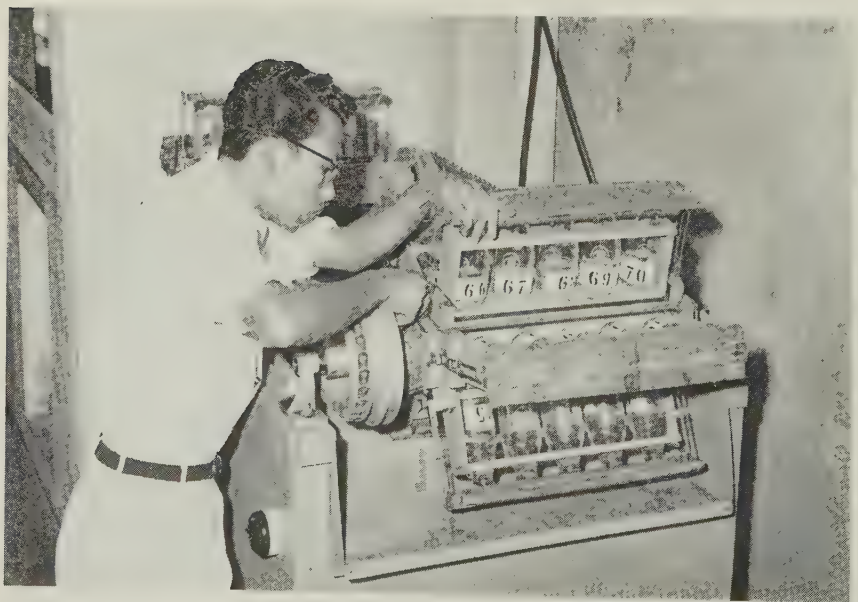
Soil samples taken during survey are brought back to the laboratory and placed in wooden trays to be dried in the sun before being analysed



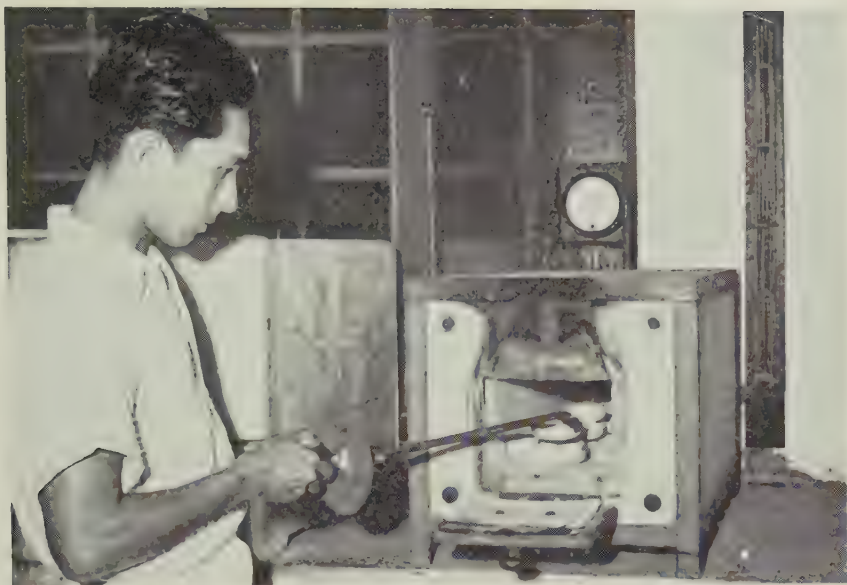
Part of a collection of soil monoliths (solid columns of soil showing the colour and structure of the various horizons) which is on permanent display in the office of the Soil Science Division in Kuala Lumpur



Measuring the physical composition of the soil with a Hydrometer



A shaking machine is used to shake soil mixed with various extracting solutions in order to determine the content of nutrients



A high temperature furnace used in determining the loss on ignition of the soil



About 40,000 analyses on soil samples are done each year in the Department's laboratories at Kuala Lumpur



Soil survey data being plotted onto base maps in the drawing office of the Soil Science Division



Soil maps being reduced by pantograph in preparation for publication

of the soil were required to aid in the selection of a site for a development scheme. The soils in two of these areas were rather poor, but the third area, near Kampong Titi Akar, was considered better and more detailed examination was suggested.

388. (iv) *Pahang*.—Further field work was carried out in the Bukit Goh Forest Reserve near Kuantan and a detailed reconnaissance map covering about 20,000 acres was drawn and a report prepared for publication. About 10,000 acres within the area examined is believed to be suitable for high fertility tree crops, including cacao.

389. A detailed soil survey was carried out on 2,000 acres of an estate reserve in order to determine what area would be suitable for the cultivation of Manila Hemp.

390. (v) *Negri Sembilan*.—A short reconnaissance was made of about 4,000 acres of land near the Sungei Lui, close to the recently opened road running between Bahau and Kemayang in Pahang. The soils were found to be either shallow lateritic types developed over undulating country or stiff pale-coloured clay soils occurring over more gently undulating land. Both soils are considered rather infertile and suitable only for rubber.

391. (vi) *Malacca*.—A detailed survey was carried out over about 1,000 acres of land near Kemendore, and a report made on the suitability of this land for development. A similar survey was carried out over about 500 acres of land at Solok Menggong which was required as an extension to a proposed development scheme in the area.

392. (vii) *Johore*.—A reconnaissance was made of several oil palm estates in the Kluang area of Johore. This reconnaissance afforded a useful introduction to the soils of the State, which have not been examined in any detail so far. Correlations were noted between some of these soils and those occurring on the west side of Singapore Island.

393. (viii) *Province Wellesley*.—A reconnaissance was carried out of Stage 1 of the proposed Sungei Juru-Sungei Jejawi Drainage Scheme which covers some 40,000 acres along the coast between the Sungei Juru and the Sungei Krian. The object of the survey was to assess to what extent the land, which is mainly cultivated for coconuts and rubber, would benefit from improved drainage. It was concluded that of the 6,600 acres covered by Stage 1, some 3,700 acres are sufficiently fertile to benefit from drainage.

394. (b) *Padi Soil Surveys*.—(i) *Trengganu*.—A short reconnaissance was made of the Paya Pending swamp, near Dungun, Trengganu. The area was found to consist of very poor soils, mostly acid peats and mucks with very high sulphate and conductivity values, and was considered to be unsuitable for large scale development.

395. An area of some 8,000 acres proposed for development as an extension to the existing Besut irrigation scheme was examined by traversing paths and *rentis* lines. Approximately two-thirds of the total area was considered to be unsuitable for development as an irrigation scheme.

396. (ii) *Pahang*.—A visit was made to the Kuala Rompin and Kuala Pontian areas of Pahang. From evidence obtained during the trip and from aerial photographs it was concluded that the large belt of swampy soils in East Pahang consists largely of very poor peat and sand. The most promising areas for padi are those in the upper reaches of the Sungei Rompin.

397. *The Paya Besar Area*.—This area was visited by a Soil Surveyor and soil sampling, along *rentis* lines, was carried out by an Agricultural Assistant. Analysis of the samples are not yet complete, but from available results it appears that a large proportion of the area is not well suited to padi cultivation.

398. (iii) *Perak*.—Bendang Bayas, a potential padi area, between the Perak and Kinta Rivers, in South Perak, was soil sampled by the Agricultural Officer. Analysis indicates that although some of the samples are sandy, the soils are promising for padi cultivation.

399. Soil sampling in the Changkat Jong area, in connection with expansion of the existing irrigation scheme, was continued.

400. (iv) *Kedah*.—Approximately 50,000 acres of the established padi-growing areas on the coastal plain have so far been mapped in detail. The area covered lies between the coast and the main north-south railway line, and is bounded to the north by the Sungei Kedah and to the south by the Sungei Aun and the Kota Serang Semut-Kobah Road. The soil boundaries were located by means of 18" diameter borings made by tractor-powered augers. These large diameter borings were necessary in order to permit direct examination of the soil profile in situ. The actual positions of the borings were located by means of chain and compass traverses tied to recognisable points on topographical maps (scale one inch to one mile).

401. (v) *Kelantan*.—A survey of the established padi areas on the Kelantan coastal plain was carried out during the dry season months of May, June and July.

402. The alluvial deposits of the Kelantan plain are quite different from those of the Kedah plain and it was found that the soils of the area fell into five major classes, depending on the conditions under which the sediments were laid down and the history of their subsequent development. These five classes are as follows:

Class *A*.—The "Bris" soils formed on the raised beaches along the coast line.

Class *B*.—The "Lagoon Soils" formed in the lagoons which developed immediately behind the raised beaches.

Class *C*.—The "Basal Marine-deposited Alluvium" which is mainly granite-derived material and is considered to underlie the riverine alluvium more recently deposited on the plain.

Class *D*.—The "Recent River-terrace soils" of the Kota Bharu District.

Class *E*.—The soils of the "Deficiency Area".

403. It was found relatively easy to identify soil classes A, B and D on aerial photographs. Also, later in the season when the soils of class D had been further classified into series and associations, it was found that the differences between these were almost entirely dependent on fairly slight differences in elevation. These latter could be observed fairly easily on aerial photographs of the area, especially since the photographs had been taken during the growing season when water was on the land. Thus fairly rapid mapping of soil boundaries could be carried out by putting in suitable traverses to check, on the ground, the position of soil boundaries located tentatively on the aerial photographs.

404. The present position as regards mapping is that all the information which can be gained from a study of aerial photographs has been transferred to maps at a scale of $2\frac{1}{2}$ inches to one mile, and detailed mapping of the soils of Group D (amounting to some 50,000 acres) has been almost completed although some further checking will be necessary.

B.—AGRONOMIC AND LIVESTOCK INVESTIGATIONS

1.—CROPS

(A).—*Padi*

(i) Wet Padi

(i) *Mechanisation.*

405. A simple winch drawn mole plough has been constructed for a drainage experiment on *gelam* padi soils in Malacca. The mole is four inches in diameter and normal working depth is twenty-four inches. The pitch can be adjusted by means of a telescopic link. It proved to be more satisfactory in operation than a commercial implement with wheel operated self lift. Depth of work was readily controlled and there was no difficulty in lifting the implement out of work but it was not possible to overcome the problem of sunken timbers in the field.

406. An engineer from the National Institute of Agricultural Engineering of the United Kingdom conducted padi harvesting trials at Pulau Gadong in Malacca. Five specially designed threshing machines were tested under various conditions as a result of which it was shown that the high proportion of broken grains usually obtained in mechanically threshed samples could be avoided. Test rigs which had an average rate of output of over 500 lb. per hour, while perhaps satisfactory in areas where padi is removed from the field before threshing, were shown to be too large for use by the farmer in areas where it is customary to thresh immediately after reaping. It was found that belt units in the form used offered no advantage over drum units. The most satisfactory machine tested was the steel rasp bar drum unit. This produced a threshed sample containing few broken grains and a low amount of loose grain ejected with the straw. A high rate of throughput was obtained and wear of the rasp bars was imperceptible. Both belt and drum units are to be tested further but development of the latter will be given higher priority.

407. A certain amount of work has been undertaken on the development of an improved animal drawn plough. The desirable characteristics of imported and local ploughs are as far as possible to be incorporated. The principles underlying the investigation are the need for a cheap, light plough, conveniently shaped for carrying and consisting of a straight, strong, easily made wooden frame and metal parts which can be constructed by a local blacksmith. A number of ploughs have been made and tested. These almost invariably have centre point shares, as has the local Malacca plough. Modifications to correct depth of penetration and to prevent crabbing have been reasonably successful.

408. It has not been feasible to initiate detailed investigation at the Padi Mechanisation scheme at Parit in the Trans Perak Irrigation area. This scheme was intended to indicate whether all wet padi husbandry operations could be efficiently mechanised as a unit under local conditions and to determine the optimum size of a mechanised farm which could be operated by one family. It has been shown that complete mechanisation is feasible where there is adequate control of water but as water supply to much of the scheme has been erratic detailed investigation has been delayed.

409. A substantial area of the 1956-57 crop had to be abandoned as a result of excessive weed growth caused by erratic supply of water. Yield from the remaining area was only 185 gantangs per acre, although 5 bird proof cages each of 0.001 acre, yielded a crop equivalent to 471 gantangs per acre. The 1957-58 crop got away to an excellent start but again erratic and inadequate supply of irrigation water resulted in the cancellation of any attempt to undertake investigational work. Weed infestation which occurred as a result of the frequent shortages of water had become fairly serious at the end of the year and hand weeding had to be undertaken.

410. A certain amount of levelling and bunding of the site was carried out during the off season and a high level internal irrigation distributary has been constructed. It was intended that the latter would solve certain of the irrigation problems which are attendant on the uneven level of the land.

(ii) *Agronomy.*

411. The majority of trials harvested at the end of the 1956-57 padi season and those laid down in the 1957-58 season were designed to elucidate some of the problems of manuring wet padi. A few experiments designed to investigate certain cultural problems were also undertaken in both seasons.

412. The more important objects of the manurial trials were to indicate the nitrogen and phosphate requirements of normal and overaged seedlings, to determine the optimum proportions in which the main nutrients should be applied to transplanted padi and to find whether water soluble phosphatic manure was more efficient than the insoluble form on padi grown on peat soils. Cultural trials dealt mainly with disposal of straw, spacing, multiple cropping, drainage and problems specific to the utilization

of *gelam* soils for production of padi and the use of off season green manures.

413. The number of manurial trials being conducted on experimental stations is gradually being reduced and in their place an increasingly large number of trials of simple design are being laid down on cultivators' fields. This policy is being adopted in consultation with the F.A.O. regional soil fertility expert and the technique is being modified as experience is obtained.

414. Some of the more important indications obtained from field investigations during 1957 are described below.

415. Yields from overaged seedlings in the nursery have not been increased by manuring with either nitrogenous or phosphatic fertiliser or both. This applies either when nitrogenous and phosphatic fertiliser are applied before sowing the nursery or when the nitrogen is applied as a top dressing one week before transplanting.

416. A review of fertiliser extension trials in Kedah and Perlis over the period 1954 to 1957 has shown that while responses to the fertilisers tested were obtained there was a considerable variation in the extent of these responses. It was concluded that the sampling methods which were used did not warrant extension of conclusions from these trials to the region in general. This is a fundamental conclusion, as it is the consequences of recommending fertiliser practice to individual farmers which is of over-riding importance. The trials indicated that the difference in overall fertiliser effects and variances between groups, although large, were not statistically significant. On the average for all blocks and all seasons:

- (i) 30 lb. nitrogen per acre (as sulphate of ammonia) increased grain yields by 135 lb. per acre;
- (ii) 60 lb. P_2O_5 per acre (as double superphosphate) increased grain yields by 162 lb. per acre.
- (iii) 30 lb. P_2O_5 was as efficient as 60 lb. in increasing grain yields, in terms of lb. grain per lb. P_2O_5 .
- (iv) Nitrogen and phosphate were equally effective when applied either separately or together.

The average yield increases, at current fertiliser costs and grain prices, would barely cover the retail cost of the sulphate of ammonia and would fall below the retail cost of double superphosphate.

417. Trials were designed and laid down in the Kedah/Perlis region in the 1957-58 season with a view to exploring this problem further. These trials have been laid down on specific soil series and are intended to provide both additional information about fertiliser requirements for the crop and to clarify requirements in terms of sampling intensities and stratification of sampling units. Strict standards of experimentation are necessary and in consequence the areas covered have been reduced.

418. A marked response to double superphosphate has been obtained on the granitic wash soils of Kelantan. On the coastal sands of the same State, however, response to phosphatic fertiliser has been poor.

419. Examination of the results from two years' work on the type of phosphate required on peat soils, as represented at Padang Kemunting Padi Test Station in Trengganu, has shown that the water soluble double superphosphate is more effective in increasing yield than insoluble rock phosphate. Nitrogen applied in the form of sulphate of ammonia appears to have no effect on yield.

420. Phosphatic fertiliser has proved to be more effective when placed in pellet form close to roots of padi sown after planting than when broadcast on the mud prior to planting. Equivalent yield increases have been obtained when only half the quantity of phosphate as rock phosphate is placed in pellet form.

421. Attempts to establish leguminous green manures in the standing padi in Kedah prior to harvest have been unsuccessful. It had been hoped that the green manure seed would germinate in the damp soil before the padi harvest and continue to grow in the off-season. Germination did not occur while water remained in the field and although germination occurred after removal of water, the land dried out too quickly for the seedlings to develop a sufficiently adequate root system for survival.

422. Shortage of senior staff precluded the continuation of agronomic investigational work on dry padi.

(B).—Oil Palm

423. Experiments at the Federal Experiment Station, Serdang, and on certain estates in Selangor were continued. Field trials at the Federal Experiment Stations, Serdang and Jerangau were maintained for the Botany and Chemistry Divisions of the Research Branch.

424. In a manurial trial at the Federal Experiment Station, Serdang, palms were found to be taking up insufficient magnesium and a substantial increase in dosage of this element has been necessary to correct the deficiency.

425. Palms in a replanting and manurial trial at the Federal Experiment Station, Serdang, have improved in appearance although towards the end of the year orange spotting of the fronds was to be seen. This was most noticeable in the more vigorous palms planted after the mature palms were felled and is thought to be due to deficiency of magnesium. Palms planted after felling the previous stand have always been better in appearance and performance than palms planted before the old stand was felled. Differences have narrowed as the palms grow older but this trend towards equality is far less marked on palms planted two and three years before felling than in those planted only one year

before felling. Approximate yields in lb. of fresh bunches per acre is as follows:

	1956	1957
Planted after felling	3,360	4,790
Planted 1 year before felling	2,820	4,220
Planted 2 years before felling	1,380	2,180
Planted 3 years before felling	380	1,640

Palms at the Federal Experiment Station, Jerangau, grew vigorously and appear to be a most promising crop in this region.

(C).—Coconut

426. Supply of coconut seed from the Port Swettenham Station for planting in progeny trials at the Federal Experiment Station, Telok Bharu, has been unsatisfactory. The former station has been abandoned for some time and is being used as a resettlement area, the palms being neglected in consequence. Seedlings of selected tall and semi-tall coconuts sufficient only to complete approximately 15 acres were planted in progeny trials. Clearance of an area of thirty acres of land was completed and both this and land cleared in 1956 were drilled with cover crop seed.

427. Interesting information is becoming available from manurial observations laid down on heavy clay soils on coconut estates in lower Perak. Nitrogen and phosphate would appear to be the more important nutrients required by young palms although magnesium also seems to have a beneficial effect.

428. Results of a manurial trial laid down on smallholders' land in Trengganu have proved to be interesting. Significant increases in yield have for some time been obtained as a result of the application of manure but in the past these increases have not been sufficient to pay for the fertiliser used. Yields have further increased in 1957 and in consequence the economic aspect is considerably brighter. Approximate figures of the average number of nuts obtained per palm are summarised below:

Average Number of Nuts per Palm 1953-1957, Trengganu

Year Treatment	Pre Treatment Year 1953-54	1st Treatment Year 1954-55	2nd Treatment Year 1955-56	3rd Treatment Year 1956-57
Control (No fertiliser) ..	16	7	8	16
7 lb. NPK fertiliser/palm/year	11.5	7.5	9.5	21.5
14 lb. NPK fertiliser/palm/year	13	9	15	37.5

It is estimated that to cover the cost of each 7 lb. increment of fertiliser an increase in yield of not less than 9 nuts per palm is necessary. A yield increase of approximately 21.5 nuts/palm was obtained from palms receiving 14 lb. of fertiliser during the 1956-57 treatment year. This yield—after deduction of 18 nuts to cover cost of the fertiliser—gives a profit of approximately 3.5

nuts per palm. The apparently delayed effect of fertiliser application resulting in increases in yield from year to year is interesting and yield data for the next few years will be examined closely.

(D).—*Pineapple*

429. A number of experiments were concluded during the year and only three new trials were laid down. The responsibility for pineapple agronomic research is to be handed over to the Malayan Pineapple Industry Board in due course and the Board is at the same time to take over management of the Federal Experiment Station, Alor Bukit, in Johore. All agronomic experiments at the Federal Experiment Station, Alor Bukit, have been concluded as staff shortage precludes their continuance. For the same reason much of the work being carried out elsewhere has been terminated.

430. A review of results of completed trials has served to indicate that application of fertiliser in liquid form as a foliar spray has no advantage over dry fertiliser applied to the soil in the normal way. The trace element copper has been shown to improve leaf colour of pineapple in certain areas but has had no apparent effect on yield or fruit size. The application of either Alpha-Naphthalene acetic acid or calcium carbide to the centre of the plant have both significantly increased percentage flowering while removal of either slips or crowns has resulted in fruit of greater size being developed.

431. A new trial to determine the effect of applying trace elements to pineapples grown in mineral soils has been laid down in Kelantan. Trials have also been undertaken to clarify the effect of different forms of soil mulch and the effect of differing intensities of shade on growth and quality of the two varieties Singapore Spanish and Sarawak grown on peat soil.

(E).—*Cacao*

432. The growth and development of cacao during the year has been most unsatisfactory and has caused considerable anxiety. A yellowing of the foliage, partial necrosis of the lamina, leaf fall and subsequent die back of terminal branches are the more obvious symptoms and have been the subject of considerable investigation. A detailed survey of a cacao estate on the East Coast has failed to reveal any correlation between the occurrence of symptoms and soil, topography, shade, incidence of pest or known disease or any known cultural practice. It is thought that the symptoms are the result of trace element deficiencies or toxicities resultant from the very acid condition of the soil.

433. Investigation has revealed positive indication of severe calcium deficiency. A manurial trial Tr. 32 which tests the nine factorial combinations of rock phosphate and magnesium limestone each absent and at single and double levels of application has shed some light on the problem. It was reported last year that applications of both limestone and phosphate had enhanced

growth as recorded by girth measurements. Both limestone and phosphate fertilisers were effective in this respect when applied alone but while response to limestone was linear in effect there was a curvature effect to application of phosphate. When both were applied together there was complimentary effect at single levels of each but this was less marked at the double level. These findings have been corroborated during the year but in addition leaf samples have been analysed. Each plot was divided into two sub-plots for sampling and the two oldest leaves from one recently set flush were taken from each of six trees in each sub-block. There being a replicate in the experiment, a total of 36 samples were collected. Results drawn from details of analyses are summarised as follows:

Phosphorus—

Uptake increased by phosphate applications (significant at 1 per cent level).

Calcium—

Uptake increased by both rock phosphate and magnesium limestone applications (significant at 0.1 per cent level).

Magnesium—

Uptake increased by applications of magnesium limestone (significant at 0.1 per cent level).

Manganese—

Uptake reduced by applications of magnesium limestone (significant at 0.1 per cent level).

Iron—

Uptake not influenced by treatments but low in all plants.

Leaves taken from the control plots have a very low level of calcium which confirms the deficiency of the element diagnosed from leaf injection and foliar symptoms. It also agrees with results of soil analysis which show the surface soil in the area contains only about one tenth as much exchangeable calcium as good cacao soils in West Africa.

434. The deficiency of calcium has resulted in the development of an abnormally high potash/calcium ratio in the leaves. Application of calcium in the form of ground magnesium limestone corrects this but does not prevent the occurrence of leaf yellowing and die back. The problem is clearly complex and further investigation is being undertaken.

435. Existing agronomic and progeny trials have been maintained during the year and a number of new short term agronomic trials were conducted to indicate what—if any—cultural factors might be involved in the leaf yellowing and die back of cacao. These trials indicated that no such factors were necessarily involved.

436. The unexplained drop in yield of cocoa from Amelonado seed gardens at the Federal Experiment Station, Serdang, reported last year is now thought to be due to malnutrition similar to that already discussed. Yields in 1957 improved

and exceeded those of 1955, nevertheless it remains an unfortunate fact that in the course of the year a yield of less than 300 lb. dry cocoa per acre has been obtained from the larger seven year old seed gardens. The average yield of West African Amelonado from two seed gardens referred to are as follows:

YIELD IN LB. DRY COCOA PER ACRE

Year	Age	Fields 44A & B	Field 46A
1955	.. 5th year ..	247	440
1956	.. 6th year ..	149	297
1957	.. 7th year ..	265	501

437. A 2⁵ factorial manurial trial involving the elements N, P, K, Ca and Mg. was laid down at the Federal Experiment Station, Serdang, during the year. This trial may be modified to incorporate other trace elements as and when further information on deficiencies/toxicities becomes available.

438. A pruning observation which has been conducted on budgrafted cacao at the Federal Experiment Station, Serdang, is providing interesting information. In this observation, mature budgrafted trees were cut back to a height of 1 ft. above ground level and a regenerating chupon subsequently selected and budgrafted with amelonado or upper amazon budwood each from a single selected parent tree. Plots of both types were then either pruned or left unpruned. Pruning was designed to ensure that the trees formed a single jorquettee at a height of approximately 5 to 6 ft. with a view to developing as rapidly as possible a dense single storey canopy giving a good ground cover. It is not possible at this stage to indicate the effect on yield of controlling physical development in this way but it is thought from the appearance of the trees that while a slightly lower initial yield may be obtained it is feasible that this will be more than justified by the benefits which are expected to accrue from obtaining a closed canopy at an early date. An important additional factor favouring this method of pruning is the easy access to the field that is possible with a high canopy. This observation will be viewed with interest over the next few years.

(F).—Tea

439. Establishment of observation plots of clonal material from selected mother bushes on the lowlands has continued at the Federal Experiment Station, Serdang. This is part of a long term programme but one which it has been possible to speed up by the development of an improved technique for rooting cuttings. The latter has been very successful and involves the use of a prepared rooting medium, adequate shade and control of atmospheric humidity. The establishment of plots of clonal material on a somewhat smaller scale is in hand at the Federal Experiment Station at Cameron Highlands.

440. A nitrogen manuring experiment at the Federal Experiment Station, Cameron Highlands, designed to test the effect on yield of increasing doses of nitrogen is now well into

its second cycle. All treatments receive an annual base dressing of 30 lb. per acre each of P_2O_5 and K_2O but the annual total rates of application of nitrogen per acre for the different treatments are 0, 40 lb., 80 lb. and 120 lb. Yield increases in response to increased application of nitrogen are near linear in effect. Each increased dose of nitrogen costs in terms of fertiliser approximately \$20 per acre and has produced an increase in yield worth about \$200 in terms of made tea.

441. An NPK 2^3 factorial trial at the Federal Experiment Station, Cameron Highlands, is now in its second cycle. Examination of results obtained from yield data in the first cycle confirms that highly profitable yield increases were obtained from applications of both nitrogen and phosphate and that these are more effective when applied together than when applied separately. Yield records to date in the second cycle appear to be following a similar pattern.

442. A tea pruning and disease control experiment laid down in 1953 completed its first cycle in 1956 and was pruned early in 1957. The pruning treatments under trial are as follows:

- P_1 Hard pruning 12 in. above ground. No rim lungs.
- P_2 Medium pruning 16 in. above ground. Two rim lungs.
- P_3 Light pruning 20 in. above ground. Two rim lungs.
- P_4 Hard pruning first cycle, medium second cycle, light pruning in third cycle.

Each plot is split for spraying and not spraying against Blister Blight disease during recovery from pruning.

443. Total yields in lb. made tea per acre over the first three year cycle are as follows:

P_1	P_2	P_3	P_4
2956	2826	2767	2818

It will be noted that yield differences between treatments are relatively small.

(G).—Coffee

444. Manurial experiments with Liberian coffee on deep peat at the Federal Experiment Station, Jalan Kebun, are continuing. It has been clearly shown that potash is essential for improved growth and vigour while copper applied to the foliage as Bordeaux mixture has a similar, if somewhat less marked effect. Despite these very definite results, growth even on plots receiving these nutrients, has not been entirely satisfactory. Errors in management have no doubt contributed to this unsatisfactory condition but further investigation has revealed that the root systems of the coffee bushes are almost invariably confined to the top 12 in. of soil. It is thought that deeper root penetration has not been achieved either as a result of the very acid nature of the sub-soil or because of periodic rise in the water table. To investigate these and other important problems a new trial was planned in outline in 1957. Unfortunately it has not been possible to lay down this trial as a result of staff shortage.

445. A small variety trial of two types of Arabica coffee is in progress at the Federal Experiment Station, Cameron Highlands. The two varieties "Mysore" and "Blue Mountain" are growing satisfactorily but yields in this, their fifth year, have been very much lower than would be expected from these coffees in their countries of origin. No noticeable varietal differences in yield have been recorded.

(H).—*Fibres*

446. A Mauritius hemp shade trial has been in progress at the Federal Experiment Station, Serdang, since 1953. Growth and yield have both been unsatisfactory and probably reflect the low fertility of the soil on which the trial is sited. The trial is designed to indicate whether an economic yield of Mauritius hemp can be obtained when grown under young rubber, the shade of leguminous trees or in the open. The rubber and leguminous shade trees have themselves not done well on this particular soil and an economic yield has not been obtained to date from the fibre crop.

(I).—*Fruit*

447. Increased production and improvement of quality of local fruit has been the subject of additional attention during the year. For tree crops the selection of material suitable for extension and the provision of information on improved cultural practice involves a research programme of long duration. Fortunately a not inconsiderable amount of work has been done in the past with certain fruit species and interim recommendations are available for these. Other fruit types and particularly citrus have not received the attention required for immediate recommendations to be made available. Plans have been made to intensify work on these crops but it has not been possible to make a start as a result of a serious shortage of senior technical staff.

(i) *Banana*.

448. A factorial manurial trial of bananas is in progress at Federal Experiment Station, Cameron Highlands. The trial is designed to indicate the fertiliser requirements of the Canary banana in the highlands and has been in progress for four years. The Canary banana "Pisang Serendah" is considered to be the most suitable variety for use at high elevations in Malaya, but it seems clear that by virtue of its poor growth and the difficulty of ripening the fruit it is unlikely to offer serious competition to bananas obtained from the lowlands.

(ii) *Rambutan*.

449. Existing variety trials were maintained but as a result of staff shortages plans for further investigation have had to be shelved. Results from harvests in 1957 have confirmed the desirability of certain clones. It has been shown that the clones R. 7 and R. 4 selected originally in 1934 are not only of good quality but in their early years appear to be the most profitable for commercial production.

450. Rambutan planted on deep peat soils at the Federal Experiment Station, Jalan Kebun, Selangor, in 1953 continue to grow very vigorously. Only a few trees have produced fruit as yet and this presumably reflects the heavy vegetative development of these trees. A number of trees have been semi-ring barked to determine whether flowering can be induced.

451. There is some evidence from studies of bud development that flower bud differentiation in rambutan is related to rainfall and nitrogen manuring. Further investigation is being undertaken.

(iii) *Durian*.

452. Growth of trees in a durian variety trial at the Federal Experiment Station, Serdang, has improved considerably as a result of the adoption of a high nitrogen fertiliser dressing. The trees are in their ninth year after planting and are expected to come into bearing in another year or so.

453. A variety trial at Degong in Perak has been carefully re-examined. As a result of mortality and other factors causing variation it has been decided that the trial which is of formal design can be treated only as an observation.

(iv) *Citrus*

454. A great deal of attention has been paid to citrus as a result of the increased importance attached to this crop as a possible substitute for imported fruit. It has already been pointed out that insufficient information is available to provide the means for rapid improvement in fruit yield and quality. With a few exceptions there is insufficient material of known value available to permit the development of a large scale extension programme.

455. Varieties of sweet orange *Citrus sinensis* which have been imported have not so far been grown successfully in Malaya. The most promising substitute at the moment is the Chinese mandarin *Citrus suhuiensis* but this is of variable quality and in consequence a fairly long term selection programme is necessary. A number of selections have been made in past years but the effective testing of these is not at present possible as a result of staff shortage.

456. *Citrus aurantifolia*, the local lime, has been recommended for immediate extension. This is to be propagated by seed, the percentage nucellar seed being thought to be sufficiently satisfactory to justify this recommendation. A Neck orange of reasonable quality known as Limau Chembol and grown in quantity in South Thailand and to some extent in Kedah and Kelantan is receiving attention. This is another possible substitute for the imported sweet orange and one which it may be possible to propagate by seed. Investigations have been planned to clarify the percentage apogamic seed produced by this variety with a view to utilizing seedlings for purposes of extension.

457. The possibility of selected clonal material being made available for purposes of extension in the future has given considerable emphasis to the need for improving means of

vegetative propagation. The problem can be effectively solved in the case of Mandarin orange, grapefruit and certain other citrus species only by producing budgrafted plants instead of marcots as used at present. Little investigation has been carried out on the more suitable types of citrus rootstock for use in Malaya and in any case few are immediately available. A rootstock observation has been planned for grapefruit in Kedah but has been postponed due to shortage of material. Arrangements have been made for the importation from Australia of the more important citrus rootstocks and this when received will be used both for field investigations and to start seed nurseries.

458. Establishment of a grapefruit variety trial has been concluded at the Federal Experiment Station, Gajah Mati, Kedah. Grapefruit obtained this season from observation plots on this station have been of excellent quality and have fetched good prices in the Kuala Lumpur market.

459. The possibility of selecting nucellar seedlings of the local Mandarin orange (*Citrus suhuiensis*) has been the subject of investigation. Results have been confusing and the possibility of obtaining from abroad suitable pollen parents to mark the gametic progeny is being investigated.

(J).—Fodder and Pastures

(i) Fodder Crops

460. Interesting interim results have become available from a factorial trial with guinea grass at the Federal Experiment Station, Serdang. This trial is intended to indicate whether improved yield and economy of production can be obtained by applying farm-yard manure to guinea grass receiving approved NK fertiliser dressing; if such treatment prevented or reduced the marked drop in yield of grass between first and second years of growth, and to determine whether phosphate previously found to be unnecessary would in these circumstances be required. In this, the first year after planting, the farm-yard manure has significantly increased yield from plots receiving NK fertiliser dressing. No significant response has been obtained as a result of applying phosphate. A yield of approximately 80 tons of cut guinea grass per acre has been obtained from plots receiving dressings in acreage equivalents of 25 tons of FYM; 9 cwt. sulphate of ammonia, 6 cwt. muriate of potash and 3 cwt. of rock phosphate.

461. A guinea grass variety and spacing trial was laid down at the Federal Experiment Station, Serdang, in October. This trial is designed to compare the yielding capacities of six strains imported from East Africa with local material and to determine their relative suitabilities for close planting and mechanical harvesting.

462. Guinea grass and Napier grass have been established in observation plots on deep peat at the Federal Experiment Station, Jalan Kebun, Selangor. Yields have been very much lower than those obtained on mineral soils. Applications of limestone appear to have substantially increased yield of Napier grass but in the case of Guinea grass increases were less apparent.

463. A number of species of imported fodder crops are under observation at the Federal Experiment Station, Kuala Lumpur. Several of these are promising and are being bulked with a view to formal investigation. A number of less desirable types have been discarded. Selected promising fodder crops under more detailed observation are *Panicum trichocladum* and *Brachiaria brizantha*. Both species are prostrate in habit but the latter is the more palatable. *Panicum trichocladum* has given a calculated yield of approximately 83 tons per acre during its first year. Equivalent yield data for *Brachiaria brizantha* is not yet available. The optimum cutting interval for both these grasses was about 50 days.

464. Russian Comfrey *Symphytum perigrinum* has been successfully established at the Federal Experiment Station, Cameron Highlands. It has been claimed by authorities in some countries that the crop has produced high yields of fodder of relatively high protein content. It has grown vigorously at Cameron Highlands and has been readily accepted as a fodder by pigs. It is being bulked as rapidly as feasible for further investigation. Attempts to establish this crop on the lowlands have not been successful.

465. Investigations of systems of mixed farming in Kelantan based on an integration of padi farming and intensive cattle rearing and incorporating off season fodder leys have been postponed as a result of staff shortages.

(ii) Pastures

466. The factorial NPK manurial trial on *Axonopus compressus* under shade of *Enterolobium saman* continued to yield interesting results. A near linear response was obtained from applications of nitrogen up to 4 cwt. per acre of urea, although this response was reduced by the presence of phosphate. Response to potash in previous years has been positive but not significant. It is of interest to note that little or no response to this nutrient has been obtained this year. The highest yield was obtained from the N_2P_0 treatment which gave 22.5 tons of fresh grass per acre during the year.

467. The pasture shade and variety experiment at Serdang has been continued in modified form. This trial has been rotationally grazed with cattle since mid 1955 and yields are determined from sample cuts of 30 day regrowth, growth during grazing not being recorded. The regular grazing of the pasture has resulted in almost complete eradication of lalang (*Imperata cylindrica*) which previously had invaded the trial thereby largely invalidating the results. Yield was highest in shaded plots planted with *Axonopus compressus*.

(K).—Tobacco

468. No investigational work has been conducted in this crop as no senior technical staff have been available for this work.

(L).—*Vegetable and Food Crops*

469. A number of long term investigations have been continued at the Federal Experiment Stations, Cameron Highlands, Jalan Kebun and Serdang but no new work has been undertaken as a result of staff shortage.

470. A long term vegetable manurial trial at the Federal Experiment Station, Cameron Highlands is in its fifth cycle. This trial is designed to test the effect on growth and yield of commercial vegetables of substituting certain inorganic fertilisers for prawn dust in general use. The latter is a very expensive fertiliser and has the serious disadvantage of encouraging flies. The treatments are as follows:

A—Prawn Dust at 5 tons per acre per annum.

B—"Sterameal Black Label" at 3 tons per acre per annum plus inorganics:

Common salt	...	...	100 lb.	} per acre per annum
Double superphosphate	...	...	450 lb.	
Sulphate of ammonia	...	...	238 lb.	

C—Groundnut and soyabean cakes at 3 tons per acre per annum and inorganics: as for B plus sulphate of

potash	...	...	312 lb.	} per acre per annum
Muriate of potash	...	...	200 lb.	

Three crops, cabbage, *lobak* (Chinese radish) and French beans, are normally planted each year but as the cabbage was affected by an unidentified disease in 1956 it has been replaced in the rotation this season by leeks. Yields obtained are as follows:

Yield of Fresh Marketable Vegetables

					lb. per acre		
Cycle					A	B	C
V	Leeks	..	..	..	515	760	564
	Lobak	..	..	..	751	874	1517
	French Beans	..	..		162	385	287

It will be seen that Mixture B was best for leeks and French beans and Mixture C the best for lobak. Mixture A, the prawn dust, gave the poorest yield with all these crops. These results confirm earlier findings that prawn dust is both inferior as a fertiliser to either bean cake or sterameal with added inorganic fertilisers and at the same time is more expensive than these substitutes, as well as being undesirable from the health standpoint.

471. A classical long term observation designed to test the effect on soil fertility of applying inorganic fertiliser to land carrying arable crops continuously and land on which arable crops and fodder grass leys are alternated every two years, has been in progress at the Federal Experiment Station, Serdang, for about 6 years. Three arable crops a year are normally carried namely maize, sweet potatoes and groundnuts. The fodder grass used is guinea grass, *Panicum maximum*.

472. The trial was reviewed in detail in 1955 and alterations in manures and cultural practice were made at that time. Crop cycles starting with maize now extend from August of one year to August of the next. The ley treatment planted in 1955 was ploughed up at the end of the 1956/57 crop cycle. Yield data since 1955 is as follows:

**YIELD PER ACRE OF DRY SEED OR FRESH TUBERS
OR SLIGHTLY WILTED GRASS**

Year	Crop	Continuous Arable Cropping		Alternate Husbandry	
		Without Inorganics	With Inorganics	Without Inorganics	With Inorganics
		lb.	lb.		
No. 5	Maize	656	616	—	—
1955-56	S. Potato	13,376	21,144	—	—
	Groundnut	264	368	—	—
	G. Grass	—	—	32.5 tons	51.6 tons
No. 6	Maize	1,496	1,576	—	—
1956-57	S. Potato	15,568	18,896	—	—
	Groundnut	1,552	1,232	—	—
	G. Grass	—	—	15 tons	21.8 tons

It will be seen from this data that very low yields were obtained from both maize and groundnut in the 1955-56 season. This may have been a reflection of previous poor cultural practice, as in 1957, far better yields were obtained. Yields of sweet potato tubers are high in both years. Yield of guinea grass showed a fairly steep drop in its second year but this is an anticipated phenomenon and is not thought to reflect a reduction in soil fertility. There has been no evidence of reduction in soil fertility but crop response to fertiliser application has almost invariably been positive; an exception is groundnut in 1957 which yielded slightly less in the fertilised area.

473. Investigation of the suitability of various vegetable crops on deep peat soils has been continued, albeit on a limited scale as a result of staff shortages. Eighteen different types of vegetables have been grown successfully and these include tomato, cherry tomato, cucumber, loofah, chillies, long and French beans, *chekor manis*, pumpkin, ladies fingers, brinjal, etc.

2. LIVESTOCK

474. It has not been possible to implement approved investigation programmes as a result of staff shortage. Existing work has been continued but no new formal trials have been initiated.

(A).—Goats

475. Attention during the year has been focussed on the production of high grade Anglo Nubian goats. The production of British Alpine and Sanaan breeds has been discontinued in accordance with approved policy and all animals of these breeds have been sold.

(B).—Pigs

476. The feeding trial at the Federal Experiment Station, Serdang, is beginning to yield interesting interim results. The trial is designed to test the relative values of feeding a high concentrate ration with a ration based on a modification of Lehman's system in which only basic requirements in terms of concentrate are provided,—the balance being made up with bulky foods. Six replications of this trial were completed during the year and three more are in progress. Results to date indicate that while there is little difference between treatments in growth rate, efficiency of food consumption or carcase quality the modified Lehman's system appears to be more economic.

(C).—Cattle

477. The Bali herd at the Federal Experiment Station, Serdang, has been maintained in good health during the year.

478. A simple observation was conducted to investigate the growth rate and food consumption of Bali cattle and to explore the economic aspect of fattening these cattle by stall feeding solely with cut fodder. Mineral licks were provided. An average live weight increase of 1 lb. per day was achieved by entire animals while castrated animals achieved a slightly lower live weight increase. It is possible that the less satisfactory performance of the steers might be explained by the fact that they were only about 11 months old when the trial was started, 10 months younger than the entire animals.

479. *Feeding Observation.*—An observation was conducted to determine the effect of feeding cattle on urea-molassed padi straw as a means of increasing available feed when grazing is lean. This investigation was based on work in South Africa where veld hay, urea-molassed, is provided as winter feed. The results were disappointing as the animals refused to take the straw. It is felt that if animals are to be fed with this type of food, it must be introduced at an early age.

C.—EXTENSION AND ADVISORY WORK

1. CROPS

(A).—Rubber

480. The area of rubber smallholdings in the Federation is estimated to be about 1.6 million acres and the field staff of the Department co-operates actively with the Smallholders Advisory Service of the Rubber Research Institute of Malaya to ensure that these growers are kept fully advised of the latest techniques of maintenance, tapping, lalang control, anti-erosion measures, manuring and the control of pests and diseases.

481. During the year the Director has been the Executive Officer of the Rubber Industry Smallholders Planting Material Scheme, 1956, and the Field Branch has been in charge of this Scheme which aims to provide high yielding planting material to all

smallholders who wish to replant under the Rubber Replanting Scheme and to others who wish to plant new land. This approved planting material takes the form of either Tjir. 1 selfed clonal seedlings or budwood of six recommended clones, namely P.B. 86, Tjir 1, RRI. M.501 and 513, G.I. and PR. 107.

482. The year has been notable for the very keen demand for stumps and for a very greatly increased demand for budwood. No smallholder has been unable to obtain planting material although there have been temporary or local shortages of certain clones such as Tjir 1 and PR. 107. However, it is impossible to forecast accurately the popularity of any one clone as this varies from season to season. Total supplies available have always exceeded total demands and the year ended with a small surplus in hand.

483. Distribution figures of approved planting material for the last five years are given below:

Year	1953	1954	1955	1956	1957
Budwood (yard) ..	68,105	122,564	190,110	191,883	258,834
Clonal seedlings ..	1,773,388	3,318,643	5,446,689	10,412,173	9,128,563

This material was distributed for the following purposes:

		Budwood (yd.)		Clonal seedlings
For new planting	..	77,487	..	2,440,632
For replanting	.. ..	181,347	..	6,687,931

484. Progress with new and replanting by smallholders during the last five years is given in the following table:

Year		New Planting (acres)		Replanting (acres)
1953	..	6,300	..	30,520*
1954	..	3,300	..	25,740*
1955	..	8,100	..	28,900*
1956	..	13,100	..	49,870
1957	..	not yet available	..	52,748

485. Purchase of seed for the 1957-58 season commenced early in July with a target of over 28 million. The seed-fall in parts of Perak was excellent but it was very disappointing in Negri Sembilan and on the Selangor coast. In spite of a ban on the export of selfed Tjir. 1 seed there was some doubt that the target would be reached and a total ban on the export of all types of seed was imposed on 14th November, 1957. At the same time the Pool agreed to buy illegitimate seed of Tjir. 1 and of certain other crosses from areas approved by the Rubber Research Institute. By the end of the year a total of 24.6 million seed had been purchased and it was reasonably certain that the target would be reached.

* Amended.

486. In the early part of the season the germination of seed was excellent but some of the illegitimate seed purchased in December was of very poor quality and gave a low germination. For this reason a somewhat higher target figure was fixed.

487. The chief practical difficulty to successful replanting by smallholders continues to be that of efficient control of *lalang* (*Imperata cylindrica*) and great interest has been shown in the use of Dowpon for the control of this weed. This herbicide is made up of 2,2-dichloropropionic acid and it has shown very great promise when sprayed on sheet *lalang* at 20 lb. per acre in 120 gallons of water. Its use has been demonstrated by the Rubber Research Institute of Malaya in many parts of the country and the Department has co-operated by publicizing these results.

(B).—*Padi*

488. It is the Government's aim to make Malaya self-sufficient in padi as soon as possible. Increased production can be achieved either by increasing yields on existing padi land or by the cultivation of new land. Unfortunately there is limited potential padi land for new planting so particular emphasis has been placed on the former method.

489. Yields per acre on existing padi land can be increased in six ways:

- (1) the provision of improved drainage and irrigation facilities;
- (2) the use of pure-strain seed of improved varieties;
- (3) full and economic use of fertilizers including the manuring of nursery beds;
- (4) better control of pests and diseases, especially of rats, padi bugs and stem-borers;
- (5) better farming practices such as the use of high-gravity seed, prompt and regular weeding, transplanting seedlings at the correct age and spacing and,—where possible—the rotation with dry-land crops in the off-season;
- (6) the extension of double-cropping wherever possible.

490. The Minister of Agriculture has directed that greatest emphasis should be given to methods likely to give quick results. One such method has been the greater use of fertilizers and it has been the Department's policy to popularize manuring by putting down demonstrations on the farmers' own land. In the 1956/57 season there were no less than 2,126 of these demonstrations and over 2,500 in the 1957/58 season. Most of these took the form of two-plot blocks with one plot given the recommended fertilizer and the other left unmanured. However, in some States larger field-scale demonstrations were put down.

491. The fertilizers used have varied somewhat from State to State but generally they have consisted of a basal dressing of double superphosphate, Christmas Island rock phosphate and

muriate of potash to provide 30 lb. P_2O_5 and 15 lb. K_2O per acre followed by a top dressing of 30 lb. nitrogen applied either as sulphate of ammonia or as urea.

492. Urea is gaining in popularity for padi because its high analysis (44 to 46 per cent nitrogen) favours its use wherever freight rates are high or the padi farm distant from a road. Excellent prilled and coated grades are now available at highly competitive prices.

493. Nursery manuring with commercial ammonium phosphate 11: 48 at a rate of 2 lb. per gallon of seed has continued to give very promising results. This technique usually accompanies improved nursery practices and it can be recommended everywhere since it gives the seedlings a good start and permits early transplanting.

494. Sales of padi fertilizer have been subsidized in five States, namely Kelantan, Trengganu, Malacca, Negri Sembilan and Johore. Approximate sales in the States have been as follows:

State	Sales in Tons	
	1957/58	Previous Season
Kelantan	1,398	926
Trengganu	380	51
Malacca	125	140
Negri Sembilan	223	61
Johore	24	23

495. Although padi fertilizers are not subsidized in Kedah some 539 tons were sold in that State, mostly rock phosphate and sulphate of ammonia, as well as an estimated 3,000 tons of local bat guano. It is known that appreciable quantities were also used in the State of Penang but no records are available of these.

496. Early in the year a campaign started to publicize the yields obtained by our finest padi farmers and to give details of their planting technique in order to encourage the vast majority of other farmers to practise similar methods and so improve their yields and income. This was achieved by writing a series of articles for the Malayan Agricultural Journal called the Master Farmers of Malaya. In the first of these articles it was shown that the champion farmer of Sekinchang, in Selangor, reaped 1,348 gantangs per acre of padi from his three-acre lot, a yield which is equivalent to 7,549 lb. per acre or 8,461 kg. per hectare. This remarkable yield from a commercial farm represents a rice yield of over two tons per acre and it compares very favourably with the world's highest known yields of any cereal. In the same area several other skilled farmers obtained yields in excess of 1,000 gantangs per acre.

497. Another article in the Master Farmer series described how a Chinese grower in Province Wellesley obtained 2,400 gantangs of padi from his two acre farm in one year. This was achieved by double cropping and by folding growing ducklings

on his land after each harvest in order to glean the fallen grain. Before the harvest the young ducklings are fed on local fish meal and their droppings are later used as a fertilizer on the padi land.

498. It is planned to publish these articles regularly since they were well received and were translated into several languages. They represent an efficient method of extension as the neighbours of such Master Farmers attempt to emulate them.

499. Double-cropping of padi offers a rapid method of increasing yields provided that suitable irrigation is available. The main centre for this farming practice is in Province Wellesley, but a smaller area is always grown in the Yen district of Kedah, just west of Kedah Peak. In addition a small area was planted for the first time in south Krian, north Perak. A total area of 7,300 acres was planted in the 1957 off-season of which 7,230 acres were harvested, giving an average yield of 373 gantangs per acre. This high average figure is most gratifying when it is considered that the 120 acres harvested in south Krian gave only 73 gantangs per acre because of very severe damage by birds.

500. In 1956 some 9,010 acres were planted with off-season padi. The reduction of 1,700 acres in 1957 was largely due to dry weather and lack of water in north Province Wellesley.

501. If double cropping is to be established in Krian it will be necessary to plant at least 2,000 acres before pest damage can be reduced sufficiently to justify the practice.

502. Improved strains of padi can now be recommended in several States and some 45,783 gantangs of selected pure-strain seed was distributed during the year as well as 18,726 gantangs of unselected seed. The pure-strain seed was grown in rogued multiplication plots on 50 Padi Experiment and Test Stations as well as on special seed-farms which were planted on contract. At present these seed-farms are confined to the States of Malacca and Negri Sembilan.

503. The value of planting pure-strain seed of selected varieties was demonstrated in 1,139 plots on growers' land, most of these being in Perak, Kelantan and Negri Sembilan with smaller numbers in Selangor and Pahang.

504. Improved methods of padi farming generally have been demonstrated very effectively by the system of selection of "Progressive Farmers" in Kelantan and Trengganu. Provided that these farmers followed and acted on the advice of the Department in all such matters as correct cultivation technique, the use of wet nurseries, seed selection, the correct sowing density, age of seedlings and planting distances and the use of fertilizers both in the nursery and field, then a free issue of fertilizer is given to them by the Department and, in some cases, free selected seed sufficient for half to one acre of padi land. There are 66 such progressive farmers in Kelantan and 22 in Trengganu and they have been a great success. Their farms demonstrate on a field scale all the main extension lines pursued by the Department

and the effect on increasing yield and impressing farmers has been considerable.

505. In agricultural extension results count more than propaganda and these were obtained in 1957 when the local production of padi amounted to the equivalent of 487,580 tons of rice, an all-time record. This represented 59 per cent of the Federation's total requirements and was more than double (217 per cent) the crop reaped in 1946.

506. A padi farmer will not spend money on fertilizers nor will he make permanent improvements to his farm unless he has security of tenure. Some protection is now provided for him by the Padi Cultivators (Control of Rent and Security of Tenure) Ordinance, 1955, and 5,583 tenancy agreements under this legislation were signed in Kedah alone.

507. The Kedah Padi Planters' Board continued its redemption of mortgages and usufructuary loans. Altogether 444 farmers have been benefited by these activities by spending \$675,070 on the redemption of 1,054 acres of padi land. In addition \$620,918 has been spent on purchasing 733 acres of leased land of which three-quarters was resold to members of Padi Planters Associations and the balance rented to them.

(i) ECONOMIC SURVEYS

508. Economic surveys were carried out during the period 1954 to 1956 by sampling 568,493 acres of padi land and the analysis has now been largely completed of the data so obtained. These surveys were carried out in Perlis, Kedah, Province Wellesley, Krian and Kelantan. Only 48 per cent of this land is owner-farmed and most of the balance is rented for padi on the West Coast or share-cropped on the East Coast. Average cash rents varied from \$65 per acre in Perlis to \$86 per acre in Krian while average padi rents range from 97 gantangs per acre in Perlis to 155 gantangs per acre in the double-cropped area of Province Wellesley.

509. A survey of tenancy agreements in Perlis, Kedah and Province Wellesley indicated that only 13 per cent were written and the balance of 87 per cent were verbal.

510. Where the crop is shared on the East Coast the landlord's share is usually 50 per cent (96 per cent of the tenancies) but it is occasionally as high as 60 to 67 per cent.

511. The religious tithe, *zakat*, is sometimes collected by landlords in addition to padi rent. In the case of 37,380 agreements in Kedah *zakat* was collected from the tenant in 1,050 agreements (3 per cent). In this State also *zakat* was collected by landlords from tenants in 70 out of 490 share-cropping agreements (14 per cent).

512. The lease is a relatively favourable type of tenancy since it gives the farmer reasonable security of tenure. Most leases are for 3 to 5 years but may be for longer periods. Cash payments have usually to be made in advance.

513. These surveys, carried out by the Agricultural Economist, have brought to light many deficiencies in the Padi Cultivators (Control of Rent and Security of Tenure) Ordinance 1955 of which the worst is that it virtually places the onus of compliance on the often illiterate tenant farmer. It is evident that this particular legislation will largely require to be re-drafted.

(C).—*Coconut*

514. The Assistant Director (Field) served on the four-man Working Committee which was set up to collect and review existing agricultural and economic data on the coconut industry and make recommendations for the improvement and development of the industry. This report was submitted at the end of October. The Agricultural Economist's Production Survey in 1956 revealed that a replanting programme for smallholders in the coconut growing areas in West Johore is necessary and urgent and a replanting scheme was recommended which would be capable of extension to other areas when the need has been established.

515. Improvement of coconuts on the sandy soils of the East Coast is largely a question of manuring. There is some evidence that the use of purchased fertilizers is unlikely to be economic unless it is subsidized. For this reason emphasis has been placed on encouraging the use of locally available fertilizers such as animal manure, fish refuse and wood ashes. 23 manurial demonstrations of this type have been laid down in Kelantan and Trengganu and the early improvement in the appearance of the treated palms has attracted the interest of local farmers.

516. In Perak 11 coconut smallholders have been given financial assistance by the Planters Loan Board in order to carry out drainage and other improvements to their land.

517. During the year a new disease appeared in south-west Johore which is now sporadic from Muar to Pontian. It is not yet known whether the cause is pathological or physiological in origin but the disease has not apparently spread to other States. In order to obtain more information a survey was carried out in late December by College students directed and assisted by Field Branch staff. This revealed that, in a random sample of 109 half-acre plots, there was a total of 35 diseased palms of which 26 were in the age class of 6 to 40 years. No correlation existed between incidence of the disease and acidity or conductivity of the soil water or attack by *Oryctes*. Further investigation is now in the hands of the Research Branch.

(D).—*Pineapple*

518. The depressed market for canning pineapples and the disgracefully high percentage of rejection at factories have severely curtailed extension activities and growers are now using less fertilisers.

519. A new leaflet on this crop has been published in English, Chinese and Malay.

520. In Selangor four cultural and manurial demonstrations have been put down on peat areas set aside for the settlement of discharged Special Constables.

(E).—*Fibres*

(1) JUTE

521. Seed crops of Segama jute have been maintained at Sungei Burong Agricultural Station in Selangor and two tons of fibre have been baled for trial shipment to the United Kingdom for sale. This variety grows well as an off-season crop on padi land in the Tanjong Karang area but the labour involved in retting and hand stripping makes it less attractive to growers than vegetables or maize.

(2) MANILA HEMP

522. Planting material of Tangongon, the recommended variety, has been maintained at Serdang and Degong and it is also available from the one commercial estate in Pahang. Some interest has been shown in the crop in this last State but no smallholdings have been planted yet.

(F).—*Other Crops*

523. The Rubber Industry Replanting Board has continued to pay a grant of \$600 per acre for replanting rubber land with approved crops. Liberian coffee, fruit, coconuts, padi, pineapples and sago are the most popular of the approved crops. During the year 4,412 acres of old rubber were replanted with these crops bringing the total to date to 13,955 acres. In addition there has been 363 acres of excess replanting with such crops without receipt of a grant.

524. Replanting rubber with other crops is only permitted after the land has been inspected by Departmental staff followed by certification that the soil is suitable for the proposed crop. Most of the planting material for this purpose is supplied from Departmental sources and advice is given on the correct planting methods.

525. The system of Progressive Farmers which has proved so valuable in improving the standard of padi farming has also been applied to small fruit growers in Kelantan, Trengganu, Kedah, Perlis and elsewhere. The emphasis has been placed on pruning and manuring demonstrations and in some cases there has been a free issue of fertilizer and of pruning saws and secateurs.

(G).—*Planting Material*

526. During the year 57,996 budded fruit trees, chiefly rambutans and durians, were produced and distributed by nurseries under Departmental control of which a large proportion were used for planting on old rubber land under grant. In addition some 1,049 fruit seedlings have been sold.

527. The following figures indicate how the distribution of budded fruit trees has progressed during the last five years :

	1953	1954	1955	1956	1957
Budded fruit trees distributed	26,781	39,898	50,582	58,246	57,996

The reduction in the distribution figure in 1957 was caused partly by a restriction in the number of approved clones and partly by a policy of building up the supply of budwood nurseries on Agricultural Stations. Until this has been done no new major increased production is possible.

528. Miscellaneous planting material distributed included the following :

Coffee seedlings	20,946
Shade tree and other seedlings	17,696
Guinea grass divisions	15 bags
Stylo cuttings	447 bags
Cacao pods	2,031
Cacao seedlings	570
Coconut seedlings	71
Coconut seed nuts	3,260
Clove seedlings	10
Arecanut seedlings	110
Pepper cuttings	46
Cover crop seed	40 lb.
Vegetable seed	20 lb.
Rambutans	18,350 buds
Durian	4,200 buds

(H).—*Amelonado Cacao Seed Gardens*

529. Some of the less successful of these seed gardens have now been abandoned but those that remain have been maintained in good condition. They serve as useful demonstrations of the correct planting and maintenance techniques.

530. Close contact has been kept with commercial development since prompt technical aid and advice is required for a new crop of this nature. The commercially planted acreage at the end of 1957 was as follows :

Locality	Area Planted (acres)
Two estates, Trengganu	856
Smallholders Pilot Scheme, Trengganu	48
Three estates, Lower Perak	211
Total	1,115

2.—MECHANIZATION

531. Now that efficient and competitive contractor services are available in many parts of the country there are fewer demands on the contract services of the Department. However, in Negri Sembilan, six tractors have been available for the subsidized cultivation of padi land.

532. In Kedah a straw baler was in use at the Telok Chengai Padi Experiment Station early in the year and it produced 3,071 bales at a cost of 23 ct. each. In Kelantan another baler was in use on smallholdings with the Department providing the services of the baler and one operator free; the farmers themselves collected and fed the straw into the baler and tied the bales. This work is an important and essential part of the Department's successful campaign to encourage mixed farming and plans have been made to have seven balers in operation at the next harvest.

3.—LIVESTOCK

(A).—Cattle

533. There is a big population of cattle in Kelantan and it is the custom there for these animals to graze on padi land after the harvest. However, during the padi season they are tethered in kampongs, along roadsides or taken to distant and often unsatisfactory grazing reserves. This problem has been tackled by a campaign to encourage mixed farming whereby selected progressive farmers are assisted to establish plots of stylo, *Stylosanthes gracilis*, and to stall-feed their cattle using baled padi straw as litter. As a corollary to this the use of wooden tubs for threshing and sickles for reaping padi has been encouraged in place of the traditional *tuai* or hand knife. The cattle manure which results from this practice is applied to vegetable gardens, padi nurseries, orchards or padi land generally. It also enables farmers to cultivate their padi land with dry-land crops in the off-season.

534. In conjunction with the mixed farming campaign the Department gave aid to Kelantan farmers for building 20 cattle sheds, each farmer receiving materials to the value of \$50. After this the construction of cattle sheds continued without further aid and there were over 100 new ones in Kelantan by the end of the year, all of them built in conjunction with the establishment of stylo plots.

535. This type of extension has also been adopted with success in the neighbouring State of Trengganu.

(B).—Pigs

536. The Middle White $\times$ Chinese Black cross is now the standard pork pig of Malaya and it is established throughout the country. So popular is the cross that it is now necessary to select within the Chinese Black population in order to maintain sufficient high-quality breeding stock to provide gilts for mating with Middle White Boars. A particularly good strain is that from Sitiawan and this has been established at several pig centres.

537. During the year 181 Middle White boars have been sold and a total of 774 Middle White and Sitiawan Black gilts. In addition 1,658 services have been carried out in New Villages and 119 at stud centres.

(C).—*Poultry*

538. During the year 426 pure-bred cockerels and 708 pullets were distributed to poultry rearers in addition to 5,499 eggs for hatching. The reduced scale of distribution is in line with the new policy of not directly encouraging pure-breds in rural areas except where conditions are specially favourable.

539. Sales of eggs for consumption totalled 68,114 hen eggs and 1,262 duck eggs.

(D).—*Goats*

540. Stocks of Anglo Nubians have been built up in order to replace the purely milch breeds such as Saanens and British Alpines which have now been discarded. During the year 13 bucks and 18 does were distributed.

4.—PESTS

541. A vigorous pest control service has been maintained by the Department and in many States special pest gangs are employed and these can move into action at short notice when the need arises.

542. In Kedah and Perlis alone the following pests are known to have been destroyed:

Rats and bandicoots	..	..	116,628
Wild pigs	..	..	1,076
Squirrels	..	..	7,881
Monkeys	..	..	983
Miscellaneous	..	..	1,328

543. In addition 3,675 lb. of poison for the preparation of baits have been distributed as well as 1,094 lb. of BHC. insecticidal dust.

544. Freshwater crabs have always been important padi pests in the north-west but they are difficult to control except by hand collection. Recently, however, it has been noted that the vigorous and robust seedlings which result from a combination of nursery manuring and other recommended techniques have proved less susceptible to crab damage than normal seedlings.

545. In Perak 23 extension trials have been laid down on farmers' land to test and demonstrate methods of stem-borer control.

546. The highly successful campaign for the eradication of Water Hyacinth by hormone herbicides which commenced in 1956 was continued in 1957 in Kota Bharu and Tumpat districts of Kelantan. As a direct result of this an extra 65 acres of padi land

was cultivated in the current season. Furthermore, an indirect benefit from this project was revealed during the December floods which drained away rapidly along the clear water courses and much less crop damage resulted than had occurred in previous years.

5.—NEW VILLAGES

547. Regular and frequent advisory visits have been paid to villages with an agricultural interest and typical services that have been provided include pest and disease control, pig stud services, the supply of planting material and of livestock and the ordering of fertilizers.

6.—SETTLEMENT SCHEMES

548. The majority of schemes set aside for discharged Special Constables have failed in spite of a great deal of advisory attention. In most cases the colonists had little aptitude for farming or rubber planting while lack of capital was sometimes a limiting factor.

549. In the case of one relatively successful scheme at Kampong Jaya Stia, in Selangor, the Department maintained a special demonstration plot alongside. It is particularly unfortunate that the whole of this scheme was wiped out by floods in November and virtually all the coffee, pineapples, fruit trees and young coconuts were destroyed.

550. Settlement Schemes for true farmers can be very successful indeed and striking examples are the three schemes in the Kemaman district of Trengganu. The people here have planted 700 acres of kampong land with young fruit trees, foodcrops and vegetables and they intend to commence work on their rubber lots in 1958. It is noteworthy that these people have received no financial assistance whatever from Government although Departmental staff have given them a great deal of advisory assistance. It is gratifying that it will be possible to provide them with financial assistance for their new planting of rubber.

551. The two land development schemes at Ayer Lanas, Kelantan and Nyalas Road, Malacca, are progressing according to plan and they have been given very considerable advisory attention. Assistance has also been given to other schemes in the planning stage.

7.—RURAL AGRICULTURAL TRAINING

(A).—*Courses at Rural Training Centres*

552. Short agricultural courses for rural personnel commenced at Cheras, Selangor, in 1952 and gradually permanent hostels and lecture-rooms have been provided until now there is one such training centre in all States, except Perak. The last one to be erected was that at Ajil in Trengganu.

553. During the year about 75 courses were conducted and 1,018 pupils attended. Most of those attending were young men with an agricultural background and the demand for places at these courses greatly exceeds the Department's present capacity.

554. A remarkable instance of self-help is recorded from Bachok, Kelantan, where the farmers themselves erected a hostel at the Agricultural Station there so that they can pay visits in rotation and receive advice and instruction from the Junior Agricultural Assistant in charge. Farmers in this district are very keen to learn and they have done this without any financial assistance from Government.

(B).—*Newsletters*

555. Agricultural Newsletters of topical and local interest were published and issued free in Kelantan, Penang, Trengganu, Kedah and Malacca. Altogether 13 numbers were published in Malay and three in Chinese; a total of 130,000 of these have been distributed free. These are particularly useful for padi extension work since vernacular jargon is such that leaflets translated centrally are of only local value.

(C).—*Lectures, Talks and Civics Courses*

556. The Department has organized large numbers of visits to Agricultural Stations and members of the staff have given appropriate talks and lectures on such occasions. They have also co-operated with the running of civics courses and have provided lectures for these.

557. A good extension worker must be prepared to give talks at very short notice whenever and wherever farmers congregate together,—at mosques, Community Halls, Penghulu's courts, schools, District shows, Rural Council meetings and elsewhere. Full use has been made of these occasions of which a particularly favourable one was provided when a Pilot Community Development Project was launched in Perlis in October.

(D).—*Agricultural Shows and Padi Competitions*

558. During the year Agricultural Shows were held in Alor Gajah, Kuala Kubu Bahru, Sabak Bernam, Kuala Kangsar and Kota Bharu.

559. District Padi Competitions were held in most padi areas followed by State Competitions. The best exhibits from these were forwarded to Kuala Lumpur for competing in the All-Malaya Padi Competition which was held in conjunction with the 22nd M.A.H.A. Exhibition at Kuala Lumpur. The first prize winner in these was a Malay farmer from Ulu Yam, Ulu Selangor, who has also been featured as a Master Farmer, as he has an excellent record for consistent high yields and quality.

D.—AGRICULTURAL EDUCATION

1.—ADVISORY COUNCIL

560. The Advisory Council met once during the year, on Thursday, 7th February. There were two changes in the membership of the Council. Mr. Chan Hin Cheung replaced Mr. Gunn Lay Teik,

O.B.E. as the representative of the Malayan Estate Owners' Association and Enche' Ismail bin Yusoff taking the place of Enche' Senu bin Abdul Rahman.

561. Membership of the Council, at the time of writing this report, is as follows:

The Director of Agriculture, Federation of Malaya
(*Chairman*)

The Director, Veterinary Services, Federation of Malaya

The Principal, Sultan Idris Training College, Tanjong Malim

The Director, Rubber Research Institute of Malaya

The Principal, College of Agriculture, Malaya

The Hon'ble Mr. H. A. Campbell, C.B.E., Representative
of the Rubber Producers' Council of the Federation of
Malaya

Mr. Chan Hin Cheung, Representative of the Malayan
Estate Owners' Association

The Hon'ble Enche' Hashim bin Awang, J.P.

Dato' Jaafar bin Mampak, O.B.E., J.P.

Enche' Jamaluddin bin Aji

Enche' Ismail bin Yusoff

The Hon'ble Mr. Yap Kim Hock

The Secretary of the Alumni Association of the College of
Agriculture, Malaya

The Registrar and Bursar, College of Agriculture (*Secretary*).

2.—COLLEGE YEAR

562. The College year was divided into the usual three terms as follows:

3rd term, 1955/56 session—15th January to 16th April;

1st term, 1956/57 session—12th June to 4th September;

2nd term, 1956/57 session—30th September to 18th
December.

3.—REGISTER OF STUDENTS

563. The number of students in training in 1957 showed an increase of 17 over the past year. This was accounted for by the bigger intake of both the Diploma and Certificate Course students. Also for the first time in the history of the College a female student was admitted for training.

564. There were no resignations or deletions from the student register during the year. The student population as shown in the Register on 31st December was as follows:

Category	Malays	Chinese	Indians	Total
DIPLOMA COURSE				
3RD YEAR STUDENTS				
Federal Government Scholars ..	10	4	—	14
Private Students	—	2	—	2
R.R.I. Students in training ..	1	2	—	3
Singapore Government Scholar ..	—	1	—	1
	11	9	—	20
2ND YEAR STUDENTS, 1956/59				
Federal Government Scholars ..	9	5	—	14
Private Students	—	1	—	1
R.R.I. Student in training ..	—	1	—	1
Singapore Government Scholar ..	—	1	—	1
North Borneo Students in training	—	3	—	3
	9	11	—	20
1ST YEAR STUDENTS, 1957/60				
Federal Government Scholars ..	11	4	—	15
J.A.A. Major Scholar (Agronomy Branch)	1	—	—	1
Private Students	—	3	1	4
R.R.I. Students in training ..	2	1	—	3
Singapore Government Scholar ..	—	1	—	1
Sarawak Students in training ..	—	2	—	2
J.A.A. Perak State Scholar ..	1	—	—	1
	15	11	1	27
CERTIFICATE COURSE				
Probationer Junior Agricultural Assistant in training	30*	—	—	30*
Eastern Mining and Metals Co., Student in training	1	—	—	1
Trengganu State Students in training	5	—	—	5
Negri Sembilan State Student in training	1	—	—	1
Malacca State Student in training	1	—	—	1
Assistant Penghulus in training, Johore	2	—	—	2
	40	—	—	40
GRAND TOTAL ..	75	31	1	107

* One female trainee from Negri Sembilan.

4.—TRAINING

565. *Diploma Course*.—Academically, the training in the Diploma Course was based on the same lines as before. Lectures and laboratory work were conducted five days each week during the term.

566. More emphasis on farm management was given in field training despite staff limitations, and a substantial increase in the planted acreage was added to the College Farm. An important and useful project carried out entirely by the students as part of their training in farm management was the two acres of contract nursery of clonal seedlings for the State Agricultural Officer, Selangor. Practical farm economics in running the College Farm was also included in practical work for senior students.

567. Facilities for practical training in market gardening, orchard management, padi cultivation, horticultural technique and poultry have also been expanded and require further expansion in view of the future programme for the college.

568. Practical training on padi hybridisation has been included in the field training of the third year students. A padi cage was constructed and two varieties of padi (Siam 29 and Engkatek) planted in pots for students to be trained in this line of research under the supervision of Mr. Van Thean Kee, the Botanist.

569. An instructional tour for 2nd and 3rd year students to Malacca, Johore and Singapore was made during the first term vacation. The tour lasted more than a week and the chief object of this tour was for students to study animal husbandry under different types of management. This was achieved by visits to the Central Animal Husbandry Station at Kluang, the Johore Farms and Plantations Ltd., near Johore Bahru and the Singapore Dairy Farm.

570. Twenty selected students assisted the State Agricultural Officer, Johore, in a coconut disease survey in the Batu Pahat and Pontian districts of Johore.

571. *Certificate Course*.—The training of Junior Agricultural Assistant Probationers was detached from the College early in the year to make way for the expansion of the Diploma Course in accordance with Government policy. Separate training centres in Kedah, Perak and Selangor have been established for the Course and the training period extended from 9 to 17 months. The revised course, which has been designed to turn out more trained men, provides for two intakes of 20 students each a year—one in May at Telok Chengai and the other in October at Serdang. The inclusion of a training centre on the East Coast has been approved provisionally.

5.—HEALTH AND RECREATION

572. The health of the students remained good throughout the year and there were no cases of serious illness.

573. Both indoor and outdoor recreational facilities were well provided for. More friendly matches in hockey, badminton and other games with schools and clubs in Kuala Lumpur were played than the previous year, because of better transport facilities.

6.—CATERING

574. This remained the College responsibility under the direct supervision of the Hostel Superintendent.

7.—STAFF

575. The College was unfortunate to lose two very experienced members of the staff in the passing away of Mr. John Chattaway while on leave in the United Kingdom and Enche Mohd. Arif bin Abdul Rahman after a short relapse of his long illness.

576. Mr. O. M. Lee, Principal, left the College on leave prior to retirement on 11th June, 1957.

577. Mrs. M. H. Lee resigned her appointment as temporary Senior Lecturer to accompany Mr. Lee home on retirement.

578. Mr. Yeoh Chong Hoe, Cadet Agricultural Assistant, left the college on resignation for further studies in England.

579. The College has been receiving all through the year invaluable help from Messrs. Van Thean Kee, Lee Sin Fook, members of the Department and Mr. A. M. Thompson, of the Food and Agriculture Organization, as part-time lecturers in specialised subjects in which they are experts.

8.—ALUMNI ASSOCIATION OF THE COLLEGE OF AGRICULTURE

580. The Alumni Association, under the able leadership of its President, Mr. Chen Jan Jee and Secretary, Mr. Pertab Singh, has been playing an active and useful part in College matters.

9.—GENERAL

581. A staff Refresher Course conducted by the Agronomy Division Officers and Agricultural Assistants was held at the College from 21st May, 1957 to 24th May, 1957.

582. Organised visits to the College by schools and Government Departments have shown a marked increase in 1957.

E.—PUBLICATIONS AND LIBRARY

1.—PUBLICATIONS

583. The Department's principal publications are the Malayan Agricultural Journal, technical bulletins and leaflets in three languages, used in agricultural extension work.

(i) *Malayan Agricultural Journal*.

584. Five issues of the Malayan Agricultural Journal were published in 1957. They were Vol. 39, No. 3 and 4 (with index) and Vol. 40, No. 1, 2 and 3. Each issue contained reports on current investigations and extension work, in addition to the following original articles which are listed with the distribution figures for each number.

- Vol. 39, No. 3.*—(Sales 440, Free or Exchange 666, Total, 1,106)
 Soil Survey Reports. No. 4, The Kuala Langat (North) Forest Reserve. By J. K. Coulter.
 Observations on the Control of Weeds in Padi Fields By the Use of Herbicides. By P. G. Coleman, D. W. M. Haynes and J. L. B. Hitchcock.
 A Census of Agricultural Machinery in the Federation of Malaya, December, 1954. By D. W. M. Haynes.
 Cauliflowers in the Highlands. By Mervyn Smith and N. Kanagaratnam.
- Vol. 39, No. 4.*—(Sales 446, Free or Exchange 654, Total 1,100)
 Effects of Toxic Levels of Sodium, Arsenic, Iron and Aluminium on the Rice Plant. By R. G. Lockard and A. R. McWalter.
 The Foliar Symptoms of Deficiencies of the Major Elements in Rice. By R. G. Lockard.
 Aspects of In-Bin Drying of Padi in Malaya Utilizing the Waste Heat of an Internal Combustion Engine. By D. S. Boyce.
- Vol. 40, No. 1.*—(Sales 444, Free or Exchange 672, Total 1,116)
 Bacterial Heart Rot of the Pineapple. By Anthony Johnston.
 Agricultural Extension in the Kuala Langat District, Selangor. By P. A. Gething.
 Soil Survey Reports. No. 5, The Federal Experiment Station, Jerangau, Trengganu. By Wm. P. Panton.
 Wet Padi Manurial Experiments on Peat Soils in Malaya. By E. F. Allen and J. K. Coulter.
- Vol. 40, No. 2.*—(Sales 519, Free or Exchange 617, Total 1,136)
 Soil Survey Reports. No. 6, The Kelantan Deficiency Area. By G. W. Arnott.
 Sungei Manik Padi Farm Survey. By T. B. Wilson.
 Mineral Nutrition of Padi. I. Nitrogen and Phosphorus Uptake of Padi grown on an Extremely Poor Lateritic Soil, Compared with that of Dry Land Crops. By K. Kanapathy.
 Master Farmers of Malaya. By E. F. Allen.
 Master Farmers of Tanjong Karang. By Ng Ngok Wah and Mohamed bin Indot.
- Vol. 40, No. 3.*—(Sales 435, Free or Exchange 663, Total 1,098)
 The Pineapple in Malaya. By J. R. Dunsmore.
 Development of the Peat Soils of Malaya. By J. K. Coulter.
 The Chemical Control of Water Hyacinth in Kelantan. By P. G. Coleman.
 Fodder Grass Cultivation. A Manurial and Variety Trial at the Federal Experiment Station, Serdang. By James S. Ure and Mohamad bin Jamil.
 Master Farmers of Malaya. By Lim Teong Theam.

(ii) *Bulletins.*

585. Bulletin No. 102, "The Field Investigations of Padi Stem-Borers, 1955-56", by I. J. Wyatt, was published during the year. Copies distributed totalled 222.

(iii) *Leaflets.*

586. Agricultural leaflets are published by the Department for free distribution within the Federation of Malaya, usually in three languages, Malay, Chinese and English. The following were published or reprinted during 1957:

	Distributed
IN MALAY—	
The Establishment and Maintenance of Fruit Trees ..	2,310
The Black Beetle (in Rumi and Jawi)	1,990
Patchouli (Nilam)	941
Cultivation of Pepper	938
Pineapple	1,796
IN CHINESE—	
Cultivation of Pepper	638
The Establishment and Maintenance of Fruit Trees ..	1,581
Patchouli	895
Pineapple	1,450
IN ENGLISH—	
Patchouli	741
The Black Beetle	868
Total ..	14,149

587. The recruitment of a Malay translator in October, 1957, enabled an increasing number of Malay leaflets to be produced.

(iv) *Articles for the Information Department.*

588. A number of short articles on agriculture prepared by officers of the Department and translated by the Chinese and Malay Translators and also all new agricultural leaflets issued during the year were sent to the Information Department for consideration for publication in *Panduan Raayat* (Malay) and *Farmers News* (Chinese).

(v) *Distribution of Publications.*

589. About 320 copies of each issue of the Malayan Agricultural Journal are exchanged for publications of other research organisations, educational institutions, etc. The publications received in exchange are among the most valuable materials in the Headquarters library.

590. The following summary shows the number of back issues of the various publications of the Department distributed during 1957:

	Sales	Free and Exchange	Total
Malayan Agricultural Journal ..	408	37	445
Malayan Planting Manual No. 2 ..	73	16	89
Special Bulletins	212	59	271
Agricultural Leaflets	—	736	736
Poultry Leaflets	—	1,083	1,083
Grow More Food Series	—	264	264
Malay Agricultural Journal	—	55	55
Leaflets in Malay	—	3,929	3,929
Chinese Agricultural Journal	—	8	8
Leaflets in Chinese	—	657	657
Tamil Agricultural Journal	—	12	12
Leaflets in Tamil	—	—	—
			7,549

591. The following is a summary of all publications sold and distributed during the year:

	Sales	Free and Exchange	Total
English	2,995	7,280	10,275
Malay	—	11,957	11,957
Chinese	—	5,230	5,230
Tamil	—	12	12
	2,995	24,479	27,474

592. Comparative figures for total revenue received during 1956 and 1957 from the sale of publications and from advertisements are as follows:

	1956	1957
	₹	₹
Sale of publications	5,116	5,105
Advertisements	1,987	1,309
	7,103	6,414

2.—LIBRARY

593. The Headquarters library of the Department of Agriculture contains nearly 4,000 books, about 30,000 bound volumes of periodicals and nearly 1,000 unbound and incomplete volumes of periodicals, most of which were issued pre-war. In addition, many thousands of pamphlets, leaflets and reprints have been received and most of these have been taken into the library stock. This considerable volume of printed matter, accumulated over a period of 52 years, forms one of the largest

libraries on agriculture and related topics to be found in South-East Asia.

594. Growth of the library stock is rapid; during 1957, about 525 periodicals and serial publications were received regularly. About 330 of these were circulated to staff of the Department as they were received. More than 100 feet of additional shelf space was provided and five Library Bulletins, listing new accessions, were issued during the year.

595. The library is open to the public daily and students, teachers and others use it as a source of reference material.

596. With a view to providing better service for the Department, the Librarian inspected libraries in Singapore and also visited the offices of State Agricultural Officers in three States and the Pineapple Canning Research Station in Johore Bahru. Lists of books and periodicals which would be of value to State Agricultural Office staff were drawn up and distributed.

597. In addition to his normal duties the Librarian undertook the reorganisation and classification of the library of the College of Agriculture, Serdang. Owing to the lack of a full-time library clerk at the College, progress was slow.

598. A considerable number of publications were presented to the Department of Agriculture library by Mr. O. M. Lee, formerly Principal, College of Agriculture, when he retired. In addition, a number of valuable serial publications not connected with rubber were presented by the Rubber Research Institute of Malaya.

F. SCHEMES SPONSORED UNDER THE COLONIAL DEVELOPMENT AND WELFARE ACT (U.K.)

1.—SCHEME D. 2203

599. A grant of £18,096 (\$155,108.57) was approved for a survey and investigation into the economics of padi production. The purpose of this investigation was to obtain an accurate assessment of the padi cultivator's true cost-of-production and to investigate certain other problems which are believed or known to affect production. In addition, the survey will provide the basic information on the various factors upon which a sound policy for expanding rice production can be based. This scheme commenced in 1954 and closed on 30th April, 1957. Expenditure in 1957 was \$1,876.06.

2.—SCHEME D. 2225

600. A grant of £31,900 (\$273,428.57) was approved for investigations into mechanisation of rice cultivation. The scheme is designed to assess the possibilities of mechanisation as an aid to padi cultivation by the smallholder. A pilot mechanisation scheme of 50 acres has been established in an area where, through the construction of drainage and irrigation works, a considerable amount of new land can be opened up for padi cultivation. The aim is to discover whether, with the aid of complete or partial

mechanisation, a cultivator can plant a considerably larger acreage than he does at present, thereby (a) producing a greater amount of padi in excess of his own needs and (b) raising his standard of living. This scheme is due to end on the 31st December, 1958. Expenditure in 1957 was \$30,672.51.

3.—SCHEME R. 747

601. A research grant of £50,500 (\$432,857.14) was approved for the establishment of an experiment station on which field investigations into the effects of various types of water control on the growth and yield of padi would be carried out. This scheme, designed to provide more information on the function of water in rice cultivation, should enable improvements to be made in the design of drainage and irrigation schemes and lead to a material increase in rice production. The scheme is administered in close co-operation with the Department of Drainage and Irrigation and commenced in 1956. It will terminate on 31st March, 1960. No expenditure was incurred in 1957.

SECTION V

AGRICULTURAL LEGISLATION

1.—ORDINANCE NO. 10 OF 1957

The Coconut Palms Preservation (Ordinance and Enactment) (Repeal) Ordinance, 1957

602. This Ordinance was passed on 8th May, 1957 (Federal *Gazette* Notification No. 1562 of 1-7-57). It repealed S.S. Cap. 141 The Coconut Palms Preservation Ordinance, F.M.S. Cap. 152 The Coconut Palms Preservation Enactment, Johore Enactment No. 45 The Coconut Palms Preservation Enactment, Kedah Enactment No. 20 (Coconut Trees Preservation), Kelantan Enactment No. 4 of 1909 the Preservation of Coconut Trees Enactment 1909 and Perlis Enactment No. 2 of 1334 The Preservation of Coconut Trees Enactment 1334.

2.—ORDINANCE NO. 13 OF 1957

The Pineapple Industry Ordinance, 1957

603. This Ordinance was passed on 8th May, 1957 (Federal *Gazette* Notification No. 1565 of 1-7-57). It amended and re-enacted the law relating to the regulation and improvement of the pineapple industry.

3.—THE PINEAPPLE INDUSTRY

(Cess on Exports) Order, 1957

604. This Order imposed a cess at the rate of 35 cents on each case of different size cans, the total weight of which does not exceed 48 lb.

605. The Pineapple Industry (Cess on Exports) Order, 1952 was thereby cancelled. (Legal Notification No. 97 of 28th February, 1957).

4.—THE TOBACCO (EXCISE DUTIES) ORDER, 1957

606. The excise duty of 50 cents per pound imposed by Section 10A(1) of the Tobacco (Licensing and Excise Duty) Ordinance, 1954, has thereby been varied as follows:

607. In respect of leaf tobacco grown in the Federation which is proved to the satisfaction of the Comptroller to be uncured leaf tobacco to be used by daun rokok manufacturers approved and licensed as such by the Comptroller there shall be imposed an excise duty of 4 cents only per pound (Legal Notification No. 95 of 21st February, 1957).

R. G. HEATH,
*Director of Agriculture,
Federation of Malaya*

APPENDIX I

AREAS UNDER VARIOUS AGRICULTURAL CROPS

		(acres)						
		1951	1952	1953	1954	1955	1956	1957
Rubber	..	3,535,221*	3,612,820*	3,727,540*	3,528,000*	3,525,000*	3,517,000*	3,520,000*
Oil Palm	..	97,377	100,182	108,265	109,000	111,000	115,183	116,000
Coconut	..	509,306	512,967	512,744	494,000	495,000	517,060	517,000
Padi (Rice)—All types	..	875,390	831,050	834,010	845,990	891,090	875,880	896,510
Total	..	5,017,294*	5,057,019*	5,182,559*	4,976,990*	5,022,090*	5,025,123*	5,049,510*
Food Crops:								
Tapioca	..	27,411	23,428	28,183	30,947	31,244	36,344	38,206
Sweet Potato	..	10,843	13,449	16,735	19,274	19,394	19,183	21,121
Sago ..	..	6,467	6,364	6,826	6,954	7,080	6,821	6,818
Sugar Cane	..	2,055	1,861	2,008	2,050	2,022	1,991	2,120
Groundnut	..	1,943	2,479	2,485	2,785	3,311	2,880	3,353
Maize	..	2,997	7,332	4,224	8,849	6,744	6,173	6,904
Yam ..	..	1,077	1,101	1,099	1,436	1,704	1,579	1,755
Colocasia	..	3,072	3,390	3,404	3,278	3,439	3,528	3,634
Ragi ..	..	39	25	111	158	101	84	73
Soya Bean	..	106	117	152	223	194	137	181
Pulses	..	784	1,569	1,945	1,556	1,415	836	695
Vegetables (Market Gardens)	..	10,671	12,640	14,910	18,106	20,204	22,174	21,671
Total Food Crops	..	67,465	73,755	82,082	95,616	96,852	101,730	106,531

* Estimated figure only, as no accurate figures are available for smallholding acreages of rubber. For each year the smallholding acreage has been estimated as 1,500,000 acres.

APPENDIX I—(cont.)

AREAS UNDER VARIOUS AGRICULTURAL CROPS—(cont.)

		(acres)						
		1951	1952	1953	1954	1955	1956	1957
FRUITS:								
Pineapple	..	24,468	24,843	23,930	27,949	34,848	44,777	45,550
Banana	..	39,988	40,257	48,508	56,384	56,831	60,545	57,928
Papaya	..	452	478	568	749	777	862	808
Cashew Nut	..	2,102	2,120	2,105	2,134	2,083	2,166	1,583
Durian	..	25,270	26,652	27,394	28,301	31,040	31,919	38,329
Rambutan	..	14,779	15,848	17,951	17,850	18,802	19,418	20,445
Mangosteen	..	7,342	8,025	8,561	8,588	8,408	8,350	8,425
Citrus Fruits	..	2,064	2,312	2,854	3,387	5,081	5,837	6,206
Mango	..	2,099	2,386	2,594	2,468	2,572	2,497	2,455
Chiku	..	1,838	2,014	2,001	1,995	1,900	2,009	1,957
Duku	..	3,279	3,436	3,775	3,806	3,777	3,782	6,029
Rambai	..	2,129	2,460	2,499	2,517	2,492	2,418	2,865
Chempedek	..	2,767	3,061	3,187	3,160	3,494	3,473	3,498
Jack Fruit	..	1,148	1,404	1,572	1,559	1,443	1,553	1,552
Other Fruits	..	31,036	28,880	26,118	26,090	22,468	24,612	16,784
Total Fruits		160,761	164,176	173,617	186,937	196,016	214,218	214,414

APPENDIX I—(cont.)

AREAS UNDER VARIOUS AGRICULTURAL CROPS—(cont.)

		1951	1952	1953	1954	1955	1956	1957
		(acres)						
SPICES:								
Areca nut	.. ..	47,659	44,862	46,300	45,417	40,303	42,974	41,092
Chillies	.. ..	2,212	3,258	3,768	4,159	4,478	4,394	3,698
Pepper	.. ..	156	204	377	678	676	724	691
Ginger	.. ..	976	1,013	974	1,263	1,344	1,498	1,532
Sireh	.. ..	2,729	2,900	2,983	3,100	2,967	2,653	2,904
Nutmeg	.. ..	80	59	55	54	82	71	95
Cloves	.. ..	226	195	183	176	175	188	190
Turneric	.. ..	838	731	959	1,097	1,088	1,086	1,038
Total Spices	..	54,876	53,222	55,599	55,944	51,113	53,588	51,240

APPENDIX I—(cont.)

AREAS UNDER VARIOUS AGRICULTURAL CROPS—(cont.)

(acres)

	1951	1952	1953	1954	1955	1956	1957
MISCELLANEOUS:							
Tea ..	8,497	8,561	8,719	9,000	9,000	9,318	9,742
Coffee ..	7,435	9,299	9,286	10,557	12,603	13,078	14,210
Cacao ..	531	295	302	418	655	946	1,321
Tobacco ..	2,109	3,830	2,579	4,489	4,200	4,018	6,096
Derris ..	428	244	426	463	512	684	1,486
Nipah ..	33,472	33,749	34,105	34,425	34,878	33,339	32,466
Gambier ..	831	932	908	910	775	716	700
Kapok ..	1,567	1,411	1,675	1,579	1,575	1,531	1,510
Impeacuanea	179	250	143	143	140	10	60
Patchouli ..	16	8	37	81	83	26	54
Citronella ..	19	27	29	30	21	17	10
Gutta Percha ..	5,635	5,635	5,635	5,471	4,642	4,642	4,157
Other Miscellaneous ..	1,213	1,437	1,448	1,494	1,376	2,054	785
Total Miscellaneous ..	61,932	65,678	65,292	69,060	70,460	70,379	72,597
TOTAL ALL CROPS ..	5,362,328*	5,413,850*	5,559,149*	5,384,547*	5,436,531*	5,465,038*	5,494,292*

* Estimated figure only, as no accurate figures are available for smallholding acreages of rubber. For each year the smallholding acreage has been estimated as 1,500,000 acres.

